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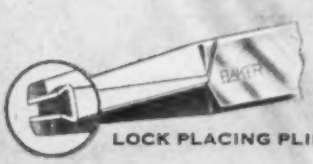

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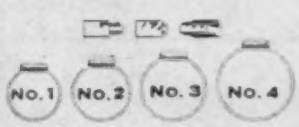

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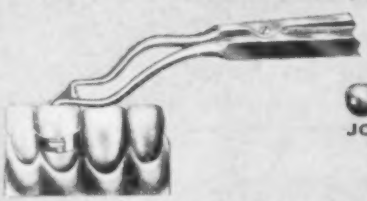

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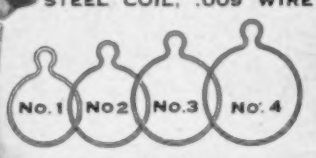

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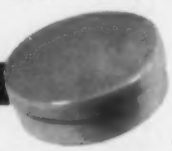

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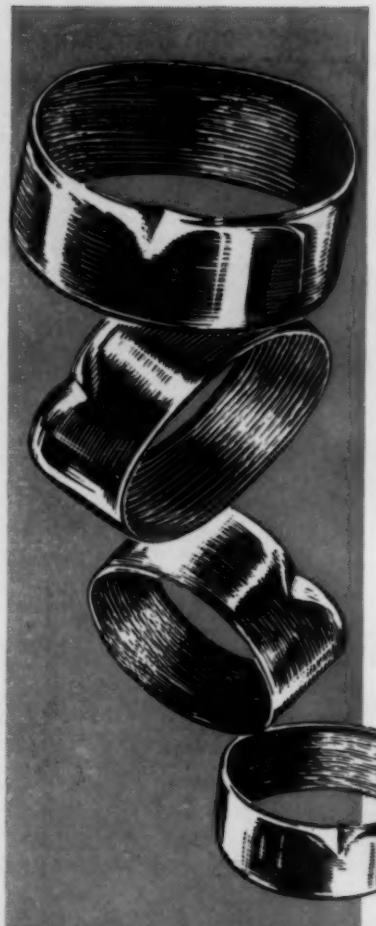

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VOL. 35 FEBRUARY, 1949 NO. 2

Original Articles

APPLIED PRINCIPLES OF THE JOHNSON TWIN-WIRE MECHANISM

HENRY U. BARBER, JR.

THERE have been a number of authoritative articles published on the twin-wire mechanism by Dr. Joseph E. Johnson, the originator of the mechanism, and other articles by many of his adherents and followers.

Nevertheless, I feel reasonably certain that no two orthodontists manipulate a given appliance in exactly the same manner in order to carry out its basic philosophy. It has, therefore, occurred to me that a description of some of the applied principles of the twin-wire mechanism as found most effective in the light of my experience would be of value, particularly to those of you who may be having difficulty in obtaining anticipated results. It is not my intention to discuss in any way the technical phases of the mechanism at this time, for Dr. Johnson and others have by their writings and teachings beautifully covered this interesting appliance.

It has been my experience, and the observation of others, that the degree of success that can be obtained depends directly on the operator's close adherence to both Dr. Johnson's technic and philosophy. In my estimation the one cannot work without the other. It is my conclusive opinion that the indifferent results or failures in the use of the twin-wire mechanism are traceable to lack of knowledge of its manipulation and are not inherent weakness in the appliance itself.

I am sure we all will agree that in the majority of cases success or failure is generally determined at the time of diagnosis, case analysis, and treatment-planning, before the actual work is begun. It is at this preliminary stage that the innumerable factors involved in the characteristic make-up of each individual patient must be given thorough consideration. It is my practice, whether in conjunction with this mechanism or any other method, to divide treatment into the progressive steps through which the particular case should proceed, and to attend to these phases as accurately as possible from the beginning to the end. This is done in the order in which they should be undertaken.

In other words, I believe in setting down those things which should be done at the beginning, in order to prepare the dentition for the major steps in the

Presented before the Northeastern Society of Orthodontists, New York City, November 10, 1947.

treatment which are to follow. For example, anchorage, as far as it is possible to use it, must be duly considered at all times. Also, the rotating and tipping of individual teeth into positions of mechanical advantage are most important in the preparatory stage.

Once started in this manner, I find it possible to eliminate many obstacles that otherwise would contribute to a long drawn out and perhaps unsuccessful conclusion of treatment. Later I shall attempt to point out a few of these important steps.

Many of my patients present themselves with rotated molars. In my use of the Mershon lingual appliance, it is a simple matter to correct these rotations at first before any attempt is made to align the buccal tubes on the molar teeth for the reception of the twin-wire.

Where lateral development is necessary, and I agree with Dr. Johnson that usually very little is needed, auxiliary springs are attached to the lingual arch, and this step is accomplished as the molars are rotated. Where upper molars are rotated only slightly, as in so-called Gothic arches in distoclusion cases, it is a simple matter to accomplish molar rotations with the twin-wire in position because of its flexibility. Elastic pressure can now be applied over a comparatively short period of time, provided there are no rotated or tipped canines or bicuspids. At this point we must be as certain as possible that we have stable anchorage in the lower jaw. For a long time I depended on the lingual arch alone, fitted closely to the gingival margins, for anchorage and stability of the molars, to which the elastics were attached, as a result of which bicuspids would be tipped buccally and mesially. The anterior teeth in many instances would become crowded out of line and tipped labially. This was due to the fact that the elastic pressure, usually greater than we had any idea of, was pulling the buccal segments forward in spite of the presence of the lingual appliance.

Some time ago I had the good fortune to become acquainted with a tension gauge invented by Dr. John E. Richmond of Eugene, Oregon. In my humble judgment he has made a most valuable contribution to our specialty, for there is no longer any excuse for an orthodontist not knowing approximately how much pressure he is using when applying elastics to treatment.

Heretofore we would select an elastic which we *thought* would give us the amount of pressure required for a given movement. We usually tested it by pulling it out between the thumb and fingers, and if we felt that the pressure was about right we instructed the patient in its use, which, in many instances, caused the tooth displacement mentioned previously. Finally when an instrument was made that could actually measure pressures in the mouth between points of attachment of the elastics in a particular case, I discovered that I was using about three times the amount of pressure I had formerly *guessed* to be correct.

Fig. 1.—*A*—Casts of a girl age 17 years. An extreme Class II division 1 case. Buccal segments are out of occlusion. *B*—occlusal view before treatment, showing upper right and left first molars missing and lower right first molar missing.

Note: Lower right first bicuspid is in linguoversion. Lateral development and rotation of canines, bicuspids, and molars are indicated prior to placing the twin-wire mechanism.

C—front view of same case, showing progress of treatment. *D*—occlusal views. *E*—right side before and during progress of treatment, and *F*—left side before and during progress of treatment.

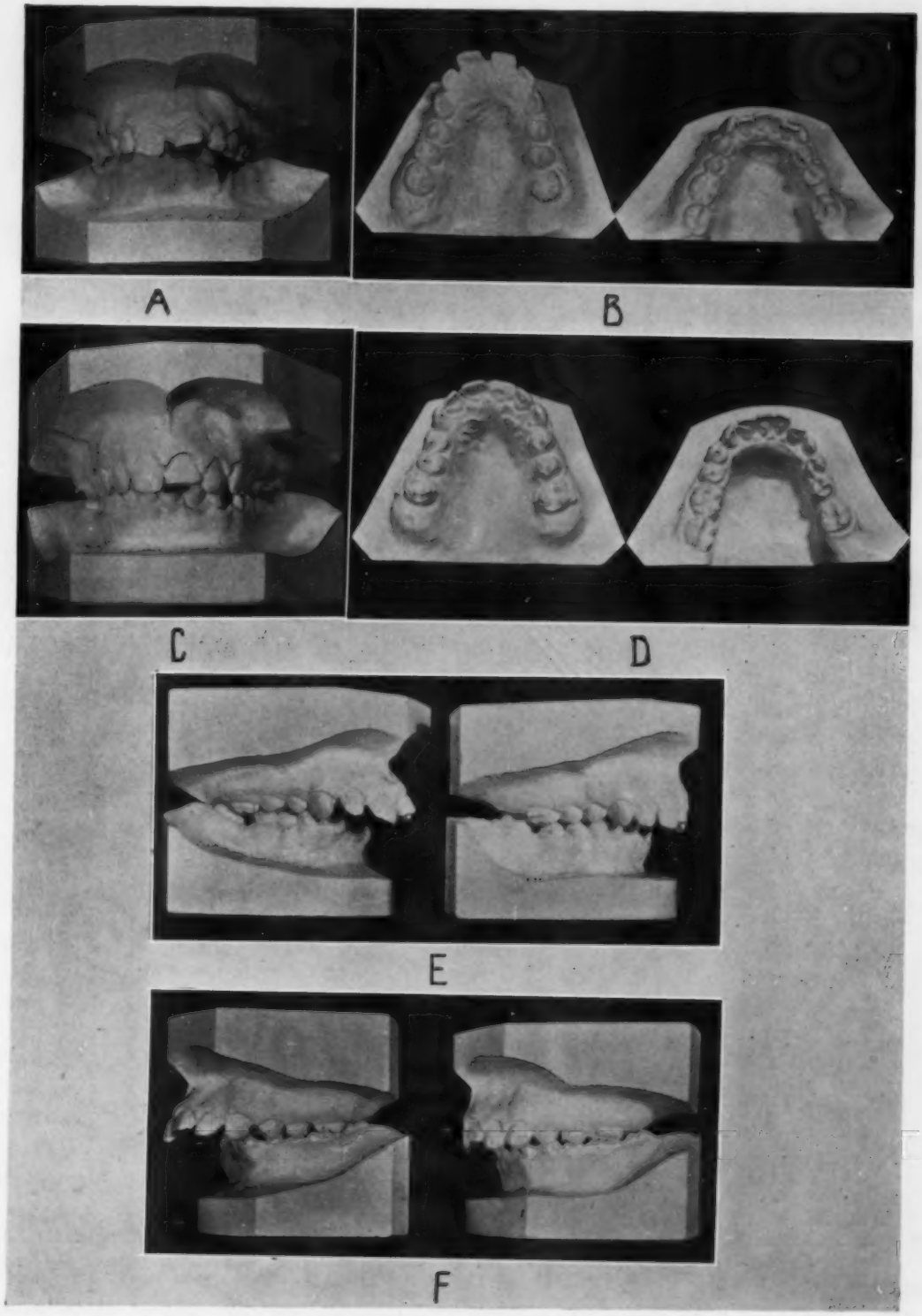

Fig. 1.—*(For legend, see opposite page.)*

This instrument is also adaptable to any type of spring so that we no longer need to guess about pressures that we wish to use.

Since I started using this gauge the facts revealed have been most enlightening. For example, I have learned that from two to three ounces of elastic pressure, applied to distoclusion treatment, will accomplish over half the correction in a comparatively short time without causing any tipping of tooth. Tenderness of the upper anterior teeth, to which the twin-wire is attached, very seldom if ever occurs.

It has been my observation, in planning treatment, that in many instances the lower right first bicuspid is tipped forward and rotated. The mesial marginal ridge is locked under the distal contact bulge of the canine. Why this is so I can only venture to guess, but I do know that to start elastic pressure, particularly in distoclusion cases with this condition present is courting trouble of the worst kind. Therefore, this correction should be made at the beginning. If the tipping is not too severe, the tooth is banded with a Johnson band. For stability the first bicuspid on the opposite side is also banded. The twin-wire is then inserted in the locks and the tooth in question is uprighted, and rotated if necessary. If the canines are also rotated, this correction can be made at the same time. Where the four anterior teeth are in good alignment, they are not banded, nor do I wire them to the twin-wire. Instead I ligate the twin-wire to the lingual arch by means of an .010″ ligature wire passed between the central incisors. This draws the twin-wire against the anterior teeth and prevents chafing the lower lip.

If the bicuspid is tipped excessively space must be made before it can be placed into its proper position. Usually the second bicuspid and first molar have to be moved distally to obtain the necessary space. This is done by banding the teeth as described above, with the exception of the badly tipped bicuspid. An .009″ stainless steel coil spring, one-half inch in length, is placed over the end tube to rest against the buccal tube which is soldered to the molar band, and an elastic is worn as in Class III treatment. At this time, the buccal tube on the left molar is pinched to bind the appliance on that side and the lingual arch, if present, is removed until the necessary space has been provided, when it is reshaped and reinserted. The first bicuspid is now banded, as in the previous instance, and brought into place. The twin-wire, which has been of .010″ gauge, is removed at this time and one of .011″ gauge is inserted for additional strength. We now have placed the lower teeth in such a position where they can be used for anchorage against elastic pressure with a minimum number of bands.

Rotated bicuspids in other parts of the mouth are most common, and I prefer to make these corrections before the application of intermaxillary pressure. This has the effect of clearing the way so that this pressure is not used

Fig. 2.—*A*—Casts of a girl, age 13 years. An average Class II division 1 case. *B*—occlusal view before treatment. *C*—front view after treatment, and *D*—occlusal view after treatment.

Note: The upper molars and bicuspids were rotated before application of elastic pressure to correct the overbite.

E—right side of casts before treatment and at two years after retention was discontinued. *F*—left side of casts before treatment and at two years after retention was discontinued.

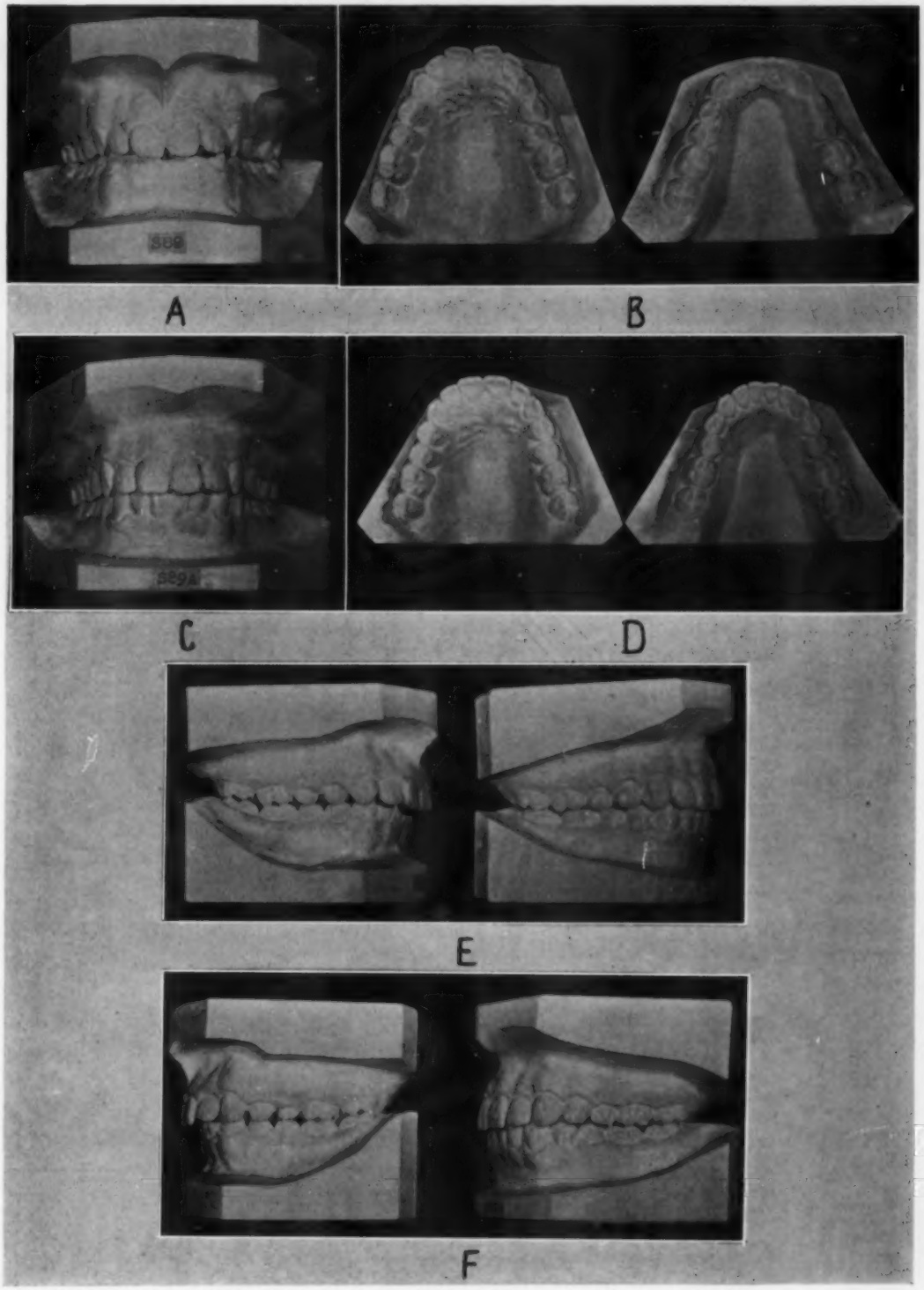

Fig. 2.—*(For legend, see opposite page.)*

over prolonged periods of time. More harm than we realize can be caused not only because elastic pressures are applied at the wrong time, but because of the lack of knowledge regarding the amount of pressure exerted.

Having attended to all of these so-called important preliminaries, we are now ready for the regular routine procedure of treatment. If this procedure is carried out in its proper sequence, it should produce a most pleasing result. Where all of the foregoing complications do not present themselves at the beginning, in spite of the fact that we are working in ounces of pressure, it is not uncommon to complete treatment in a reasonable period of time to the satisfaction of all concerned. It has been my experience that in many of these cases, normal occlusion can be established in from twelve to fourteen months.

The rapidity with which overbites are corrected with the twin-wire mechanism has always fascinated me. Biteplates have been practically eliminated from my practice except for retention, and occasionally in Class II division 2 (Angle) malocclusions with deep overbite. When the twin-wire mechanism is inserted at the beginning of treatment with instructions in myo-functional therapy, the bite is opened more quickly, permitting application of both upper and lower anterior bands, which otherwise would be most difficult to insert and most uncomfortable for the patient.

One of the great errors committed by those operators not having any, or very little instruction, in the use of this appliance, is the application of coil-spring pressure on the molars too early in the treatment. According to the Johnson philosophy, this step should not be taken until the upper and lower anterior teeth come into contact and the upper bicuspids or canines, or both, have been depressed enough to be out of occlusion. When this occurs, and spring pressure is applied, the upper molars are moved distally to assume a Class III (Angle) relationship to the lower molars when treatment is discontinued. At this time, in many instances, the anterior teeth assume an edge to edge relationship. By inserting a retaining plate on which has been built a bite ledge, the surface of which has been established to permit the lower anterior teeth to relapse into an average overbite, the vertical growth in the molar region seems to be maintained. This I believe to occur since in my practice plates are worn continuously for a short period of time, and then at night only in conjunction with masseter-temporal exercise. The fact that the majority of treated cases remain stable after all retention is removed would seem to justify the procedure presented in the foregoing.

It is obvious in this philosophy that the installation of the twin-wire mechanism in its entirety is not performed at the beginning of treatment in the

---

Fig. 3.—*A*—casts of a girl, age 10 years. Lower permanent and deciduous molars biting lingually to uppers. *B*—occlusal view before treatment. Note the difference in width between the upper and lower molar region.

Note: A plain upper labial appliance and lower lingual appliance fitting closely to the gingivae of all teeth were used. Two ounces of elastic pressure were used across the bite from buccal of upper molars to lingual of lower molars with a slight adjustment of both arches.

C—occlusal view, 10 months later. Width between the right and left molars in the upper jaw was reduced from 50 mm. to 44 mm., while the width between the lower right and left molars was increased from 32 mm. to 41 mm. Patient was without appliances for eight months, when the twin-wire mechanism was inserted. Treatment was terminated early. *D*—right side before and at termination of treatment. *E*—left side before and at termination of treatment.

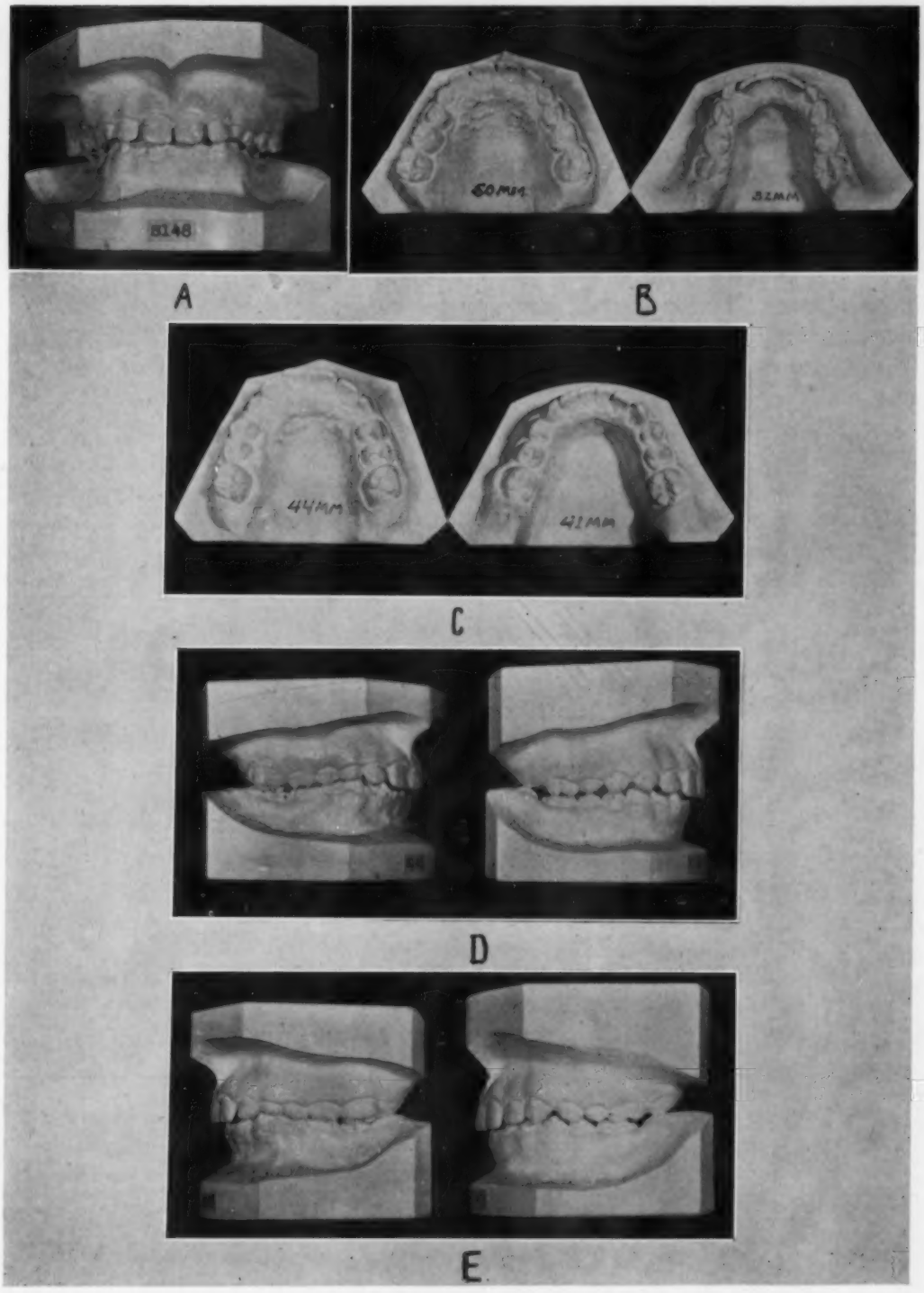

Fig. 3.—(*For legend, see opposite page.*)

majority of cases. It is applied only after all preliminaries and necessary preparations for its use have been accomplished.

In a large number of cases, the rotating and uprighting of the axes of the anterior teeth necessitate the use of multibanded appliances. The twin-wire mechanism will be found to be ideal for this purpose.

The Johnson band, being three-thirty-seconds of an inch in width, permits its adaptation gingivally to the contact point of the tooth and may be fitted perfectly without festooning or having it impinge on the gingival tissues. The gauge of .005″ establishes sufficient strength for security of attachment.

The mild gentle stimulus of the twin-wires is thoroughly tolerated by the peridental tissues and all other structures involved, and is well within the range of physiologic limits whereby tooth movement is accomplished with steady progress and a minimum of discomfort.

In extreme conditions of mal-alignment the twin-wire can be made reasonably passive by crimping into the irregularities at the beginning of treatment, after which a new twin-wire can be inserted at proper intervals to meet advancing tooth movement.

For final alignment an .011″ gauge wire, which fits more snugly into the locks, can be inserted to complete the treatment.

A careful study of the origin and progressive stages through which the evolution of modern orthodontic appliances has passed reveals an interesting series of facts.

Prior to 1900, what may be referred to today as different schools of thought, would be comparable in those days to a few of the pioneer geniuses who carried on their various principles as individuals. Included among the immortal group of that period and sufficient for the present consideration appear the names of Edward H. Angle, Calvin S. Case, and Victor Hugo Jackson.

Doctor Angle's appliances consisted principally of the "D" anchor band and "E" alignment arch, also other parts which included jackscrews for expansion. He devised a 16 gauge looped spring which could be attached to the threaded ends of the "D" bands and stretched across the palate for expansion. He also used occipital anchorage by means of a manufactured headcap which could either be attached by an extraoral bit-like bow fastened with a universal joint to the midline of the upper labial arch, or to an aluminum chin cap. By connecting either one of these anterior parts to the occipital cap by means of heavy rubber bands, treatment was effected for maxillary protrusions or protractions, or the reduction of mandibular prognathisms.

Fig. 4.—*A*—Casts of a girl, age 20 years. A badly neglected mouth. *B*—occlusal view before treatment. Patient was concerned about the unsightly appearance of the upper left canine only. Treatment consisted of a pin and tube appliance on the lower dental arch. The upper left canine was banded with an intermaxillary hook attached to the band. An attachment was soldered to the pin and tube appliance at the lower left second bicuspid for engaging an elastic to move the upper left canine downward and backward. After the upper left canine was brought into position, the twin-wire mechanism was placed on the upper teeth and intermaxillary elastics were worn until the protrusion was corrected. Since the bite was still open an incisal elastic attached in a triangular form, and exerting three ounces of pressure, was worn together with the necessary adjustment to permit the upper anterior teeth to move downward. This was continued until the teeth assumed a reasonable overbite. Upper and lower removable retaining appliances were inserted, worn for about six months, and then discarded by the patient. After two years the teeth looked better than they did shortly after treatment had been completed. The only relapse at all noticeable was the drifting distally of the lower left bicuspids, which could have been due to poor positioning or lack of molar contact support, or both. At no time did elastic pressure exceed three ounces.

C—front view, and *D*—occlusal view after treatment. *E*—right side before treatment and after retention was discontinued by patient. *F*—left side before treatment and after retention was discontinued by patient.

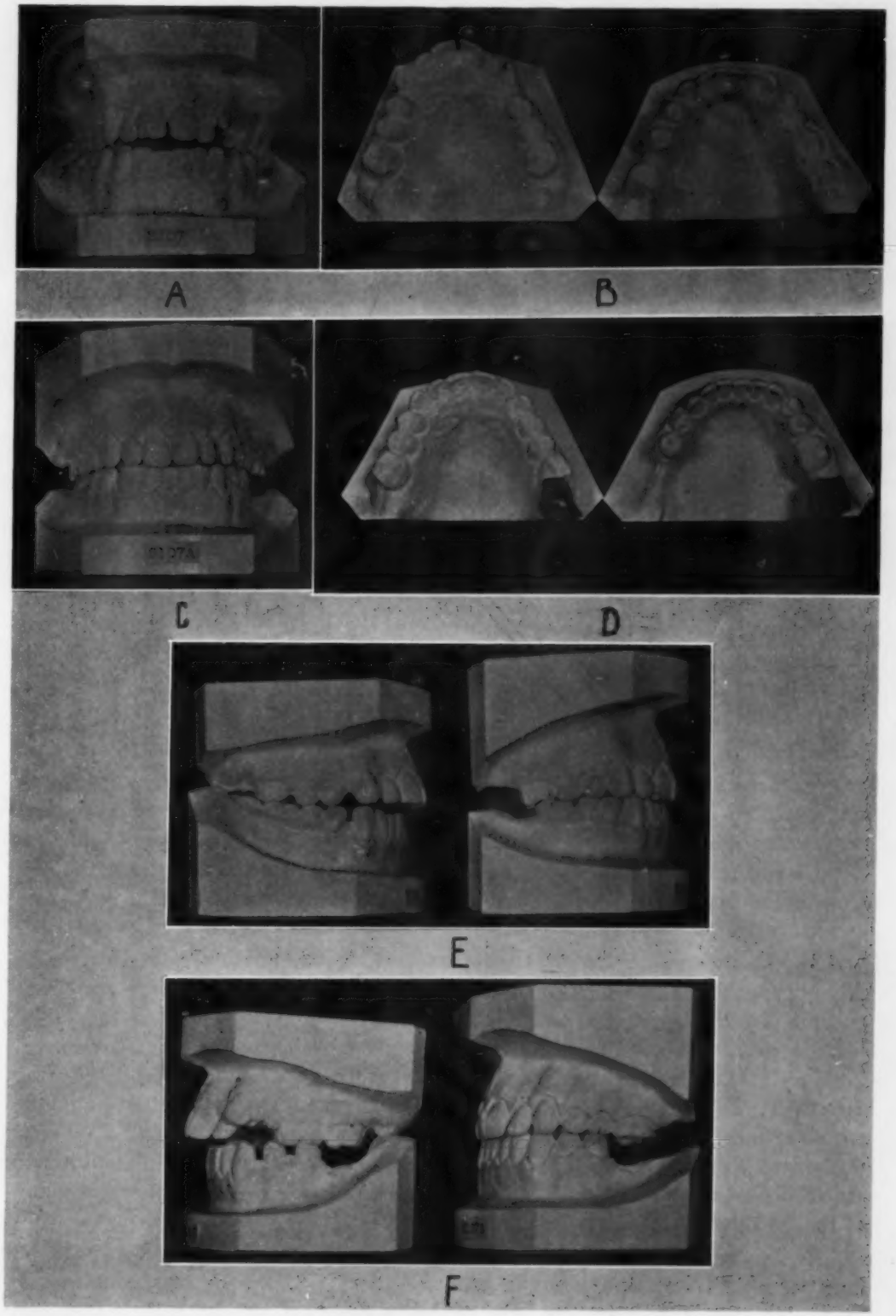

Fig. 4.—*(For legend, see opposite page.)*

A study of these early methods shows that he recognized the primary importance of security of anchorage. It was quite apparent that even though he recognized the value of springs and elastics, it was necessary for him to employ the intermittent and variable forces of jackscrews and ligatures because his basic principle was fixed appliances.

Doctor Case showed his genius in a wider range of mechanical designing of his appliances, and manufactured many parts which could be assembled in various designs. He too recognized the basic value of fixed anchorages, but in the application of tooth-moving stresses he employed the use of jackscrews, ligatures, springs, and elastics. He also used occipital anchorage for both maxillary and mandibular retractions.

Doctor Jackson's system of regulating appliances employed only the use of springs as a means of traction. The Jackson appliance, necessarily removable for adjustment, was handicapped by the fact that the slightest variation of position could alter its relation to the teeth, thereby producing unstable anchorage. This serious disadvantage was overcome later largely by the banding of certain teeth and arranging buccal attachments so that the appliances could be removed for adjustment and more accurately replaced. He also employed the use of occipital anchorage and intermaxillary elastics.

Contemporary to this period, when the foregoing and other men were making their contributions to what was then an unpredictable future, Doctor H. A. Baker of Boston gave to the science of Orthodontics elastic traction, which is now in universal use.

It will be seen from the works of these four men alone that they recognized and employed, sometimes in crude fashion, all the basic principles in use today.

During the later period of Doctor Angle's career, the various changes he made in his appliances were based on maintaining stability of anchorage, but employing different removable attachments whereby the principles of springs could be utilized. This evolution marked his progress from the original "E" arch to the pin and tube, the ribbon arch, and the edgewise mechanism in its present form.

Significant among Doctor Case's later efforts was an appliance which he called "The Midget." This consisted of banding the four or six upper or lower anterior teeth, the attachments being small open clips soldered to the labial surfaces with the openings pointing cervically in both arches. On the buccal surfaces of the molar bands were soldered split tubes with openings facing occlusally. Through the apertures of these attachments would be laced a single strand of straight length .015″ gauge spring German silver wire. This appliance worked very effectively in rotations and final alignments. It was interesting to note that this appliance, as little as it was known, fulfilled the prophecy of many of the best principles in use today.

Others made important contributions of equal value in this constant and indispensable trend of evolution. Among them was the development of the linguo-labial technic, together with the philosophy of its use contributed and

made notable by Dr. John V. Mershon. This must be recognized as an achievement which was presented just at a time to fill an indispensable place in the forward progress of adapting these same basic principles with which his predecessors had worked. It is thus obvious that the evolution of all modern appliances has been brought about by the elimination of the objectionable elements of all past appliances and the combination of their best features.

In the meantime, continued progress through research in the basic sciences has elevated treatment from the old mechanical procedure into an applied therapy. In this way any appliance alone is only an integral part of orthodontic procedure as a whole and effective only to the degree of the soundness of the principles on which it is designed and operated.

In recognition of these facts the mechanism provides many of the requirements of the ideal appliance. In conjunction with suitable lingual appliances designed best to accomplish essential steps, and strictly adherent to the teachings as set forth by Dr. Johnson, this constitutes in my experience one of the most efficient methods of treatment at our disposal today.

CLINICAL OBSERVATIONS ON THE AXIAL INCLINATION OF TEETH

B. F. Dewel, D.D.S., Evanston, Ill.

ORTHODONTIC progress in the last twenty years has been notable chiefly because of an intense interest in the relation of teeth to supporting structures. It has received its greatest stimulus from a new diagnostic aid which has come to be known as cephalometrics, the impact of which has been momentous in determining the possibilities and limitations of orthodontic treatment. Those orthodontists who entered the specialty before the advent of the cephalometric age have watched this development with approval and more than a little admiration for the men who have been responsible for its progress. Without a doubt, cephalometrics has been one of the major milestones in the analysis and correction of malocclusion of the teeth.

With its development, however, there has been a tendency to ignore or discount many of the significant signs and symptoms provided directly by the teeth themselves. This tendency very possibly has not been recognized by the older men who have been active from the first in cephalometrics because they have retained their earlier skill in analyzing malocclusion from clinical evidence, which they probably still subconsciously combine with their newer knowledge of cephalometrics. While the value of cephalometrics is unquestioned, it remains therefore an advantage to be able to combine with it adequate clinical observations, since any evidence is important in solving treatment problems that remain with us no matter what form of diagnosis is utilized.

Cephalometrics, of course, supplements clinical decisions with accurate data on growth centers, deep areas of deficient development, means and ranges for various diagnostic planes and angles, and age factors projecting future growth possibilities. It is also helpful in determining progress by superimposition of tracings secured from headplates at different ages and periods of treatment, and it has provided standard measurements of the accepted normals which are useful in determining the extent of structural deviations in the abnormal.[1]

But orthodontic diagnosis, being an art as well as a science, cannot be reduced to a purely mechanistic approach. For this reason, every orthodontist must develop and maintain an alert sense of clinical judgment in analyzing the local symptoms presented by teeth in malocclusion. These intraoral signs are still of the greatest importance to the clinical practitioner to whom cephalometric assistance is not yet available. With sufficient care and skill, it therefore remains entirely possible for an experienced orthodontist to be reasonably accurate in analyzing deviations of the teeth and related dentofacial structures from local

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symptoms alone, whether they occur in one arch, in both arches, or in the entire denture in relation to cranial anatomy.

For these reasons, a review at this time of modern clinical diagnostic methods and aids may be appropriate, not only for those orthodontists who still rely with favorable results on such observations, but also for the younger orthodontist for whom cephalometrics has received the greater emphasis.

This discussion will be limited to but one phase of clinical diagnosis—the study of the axial inclination of teeth, particularly in those cases in which remote facial structures are reasonably well developed and related. Full recognition is given to the fact that there is no adequate substitute for cephalometric appraisal of marked structural deformities of the dentofacial complex; also that cephalometrics verifies clinical decisions in questionable borderline cases in which an error of judgment may mean failure in treatment. But in so doing, the conviction also is expressed that a complete understanding of clinical analysis is essential if a full and well-rounded orthodontic diagnostic ability is to be achieved.

DIAGNOSTIC IMPLICATIONS OF THE AXIAL INCLINATION OF TEETH

The fact that teeth tend to tip beyond accepted limits when they assume positions other than the normal accounts for the clinical importance of the axial inclination of teeth. But different teeth present different degrees of angulation, whether in normal occlusion or in malocclusion, and some of them are more persistent than others in maintaining an increased inclination once it is taken. The clinician must learn to evaluate the symptoms disclosed by the various deviations. No single tooth, of course, can be depended upon to analyze dental irregularities. But selected key teeth have greater value than others for this purpose. Among these are the upper cuspid and upper first molar, and the lower lateral incisor, cuspid, and first premolar combined as a diagnostic unit.

Normally, none of the crown portions of these teeth varies more than a few degrees from the vertical in relation to the occlusal plane. Any deviation from the normal shows up primarily as an increase in the mesial inclination, or as a rotation, of one or more of them. Although other teeth may be useful in verifying their symptoms, none is more reliable in analyzing the extent and character of the usual dental irregularity.

In discussing the implications of abnormal inclinations of individual teeth, it is first necessary to acknowledge the variations and characteristics of the normal. Every orthodontist is aware of the ideal conception of normal occlusion of the teeth. There are, however, various facial types; also various concepts of pleasing facial contours. The first varies according to race and origin, and the second varies through the centuries according to the current cultural and popular conceptions of beauty and esthetics.

But in the dental mechanism there is little variation, except for facial type, in the essential clinical nature of the normal inclination of teeth (Fig. 1). It is characteristic for teeth to have varying degrees of mesial inclination, and for a most important reason. It is one of the means by which they are kept in tight

contact, not only on eruption, but also in later years when contact areas have worn down through the wear and tear of function. In orthodontics, this is a physical principle which has been known as the anterior component of force. This force apparently is activated by the functional stress of opposing teeth, inclined in the same direction, coming into occlusion under pressure.

Whether this force is the conclusive factor in maintaining contacting relations between the teeth is now questioned. There is also evidence that it may be due primarily to a recurrent apposition of bone throughout life on the distal wall of each alveolus, and that this bone apposition is in fact responsible for the mesial movement of teeth.[2] In addition, there exists a forward propelling action of the muscles of mastication on the posterior ends of the dental arches. For example, the buccinator crosses from buccal to lingual back of the last molar to its attachment to the pyterygomandibular raphe.[3] Also, located in favorable positions for the creation of mesial pressure on teeth are the masseter, temporal, and internal pterygoid muscles.

Posterior teeth, moreover, seem to be designed individually in such a manner as to encourage their mesial migration, no matter what the explanation of the process (Fig. 2). When extracted teeth are posed vertically free from any facial plane, their crowns, almost without exception, do not appear to be placed directly above the apices of their roots.[4] Instead, the crowns have the appearance of being offset somewhat mesially of center, with their mesial surfaces extending farther anteriorly than their distal surfaces do posteriorly. For example, the apex of the distal root of the lower first molar is located immediately below or even slightly distally to the distal contact area of the crown, and the apex of the mesial root lies below the buccal groove, which means that its location is the full width of a cusp distally to the mesial contact area of the crown. The roots of the upper first molar show similar, though more moderate, distal positions to crown landmarks. This distal relation of roots to crowns is characteristic of virtually all normally formed teeth.

Consequently, a line bisecting the crown of a tooth is slightly mesial to a line bisecting the root. These lines, moreover, are not parallel; instead, the bisecting line of the root angles backward from that of the crown so that the root appears to swing off in a distal direction (Fig. 3). Nor are they straight lines, but curved lines describing an arc extending distally from the occlusal surface to the apex of the root. Thus, the over-all long axes of teeth are not at right angles to occlusal surfaces, but the crowns are more nearly at right angles to the occlusal plane than the roots. This accounts for the differences in crown inclination from root inclination, the crown being the more vertical of the two. In effect, it gives the root a greater mesial inclination than the crown, which in turn accentuates the apparent mesial inclination of the tooth as a whole. Pressure brought to bear on any object so designed would favor a tipping movement, which, in the case of teeth, would be in a mesial direction.

Thus acknowledgment is made of factors in crown design, bone apposition, muscular pressure, and axial inclination for the purpose of maintaining contacting relations between teeth. But they also provide evidence that teeth tend

Fig. 1.

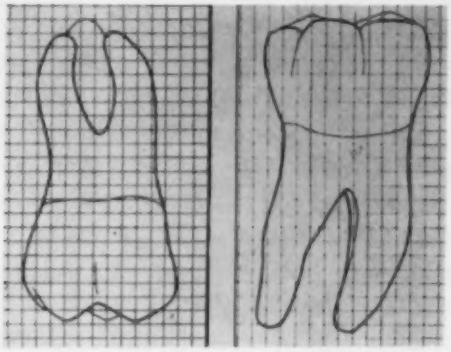

Fig. 2.

Fig. 1.—Normal occlusion illustrating varying degrees of axial inclination of teeth in relation to the curve of Spee. Line describing curve added to original illustration. (From Wheeler, Russell C.: Dental Anatomy and Physiology, Philadelphia and London, 1940, W. B. Saunders Company.)

Fig. 2.—Long axes of roots are not parallel with long axes of crowns nor at right angles to occlusal surfaces. Instead, lines bisecting roots of all teeth have greater mesial inclinations than do those bisecting crowns, as shown in these scale outlines of the upper and lower first molars. (From Wheeler, Russell C.: Tooth Form, Philadelphia and London, 1939, W. B. Saunders Company.)

Fig. 3.

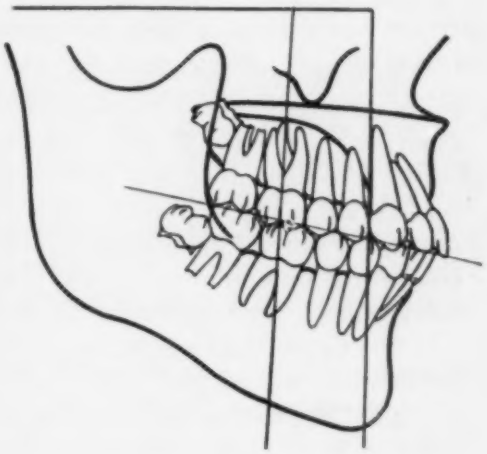

Fig. 4.

Fig. 3.—Lines bisecting teeth describe arcs with varying degrees of curvature in a distal direction, and crowns are more vertical than roots in relation to the occlusal plane. (From Noyes, Frederick B.: Dental Histology and Embryology, ed. 4, Philadelphia, 1929, Lea & Febiger.)

Fig. 4.—This cephalometric tracing illustrates differences in angulation between the Frankfort horizontal plane (top line) and the occlusal plane (occlusal line inserted in this reproduction). Teeth present greater angles of inclination when related to the slanting occlusal plane than they do with either a horizontal plane or on the curve of Spee as shown in Fig. 1. (From Broadbent, B. Holly: Ontogenetic Development of Occlusion, Angle Orthodontist **11**: 223, 1941.)

to move mesially, and that they may do so beyond normal limits. It is when this occurs that the diagnostic judgment of the orthodontist is put to test. And it occurs all too frequently, for most of our major problems in treatment revolve around the repositioning of teeth that are placed in one way or another too far mesially to facial and cranial anatomy.

Before proceeding to a detailed study of individual teeth, comment should also be made on the various planes in use to determine the degree of angulation of teeth (Fig. 4). Contrary to the Frankfort plane, which is considered to be horizontal, the occlusal plane slants downward and forward. Obviously, a normally inclined cuspid, for example, would show a greater angle of inclination on a slanting plane than it would on a horizontal plane. It is doubtful, however, whether the clinical orthodontist uses either the horizontal or the flat occlusal plane in visualizing cuspid inclinations. More likely, he relates the cuspid to the natural curve of Spee (Fig. 1). This, in effect, reduces its angle of inclination, since the curve sweeps upward as it progresses anteriorly. Therefore, what to the occlusal plane on the cephalometric tracing is a fairly marked angle of inclination, is to the curve of Spee only a moderate mesial inclination. The clinician, moreover, also uses the relatively vertical crown portion of the tooth instead of the more mesially inclined root in his analysis. Thus, the clinician and the cephalometric observer analyze orthodontic deviations from different planes, which leads to confusion and misunderstanding. There should be greater uniformity if the two groups are to speak the same language in their common observations on dental irregularities.

THE AXIAL INCLINATION OF THE UPPER CUSPID

In analyzing deviations in the axial inclination of individual teeth, the upper cuspid offers the best example of the tipping reaction that occurs when abnormal forces act to alter the position of a tooth. Other upper teeth, of course, also tend to tip at first when assuming positions that vary from the normal, but many of them seem to have in addition the ability to re-establish reasonably normal inclinations in their new positions. This creates for them the misleading illusion of a normal location in the dental arch, which in turn reduces their value for diagnostic purposes.

The upper cuspid is not as deceptive; it is much more persistent in retaining an abnormal inclination when once assumed, and thus is a far more reliable guide in determining the character of malocclusion from changes in the position of its crown (Fig. 5). Herein lies its diagnostic importance. Because the crown of the upper cuspid normally varies only a few degrees from the vertical in relation to the occlusal plane, any deviation from that position can be detected by an increase in its mesial inclination. This can be determined clinically by examination not only of the inclined planes and labial crown contours, but also by the outline of the canine eminence in the alveolar process. Its over-all length, of both crown and root, makes this apparent to the careful observer. For diagnostic purposes, the cuspid needs only mental repositioning back to its normal crown inclination to visualize it in its correct position. Other teeth thereafter may be related properly to this new visually corrected position of the cuspid's crown.

The reasons why the upper cuspid is more persistent than other teeth in maintaining an abnormal inclination once it is taken lie in four characteristics peculiar to it alone. These are the location of its apex, the length of its root, its time of eruption, and the contours of its crown. These factors are not only responsible for the increase in its axial inclination when it deviates from a normal position; they also aid in resisting any change from that inclination when once assumed. In this, the upper cuspid is more constant and reliable than any other tooth with the possible exception of the lower cuspid.

Its ability to maintain an increased inclination is due in part to its exceptionally deep area of development in a region that is immune to the usual forces that alter the positions of teeth (Fig. 6). Before erupting, the cuspid crown completes its calcification at a much higher level than any of the other teeth. Its tooth bud lies above the apical plane of the incisors and premolars well up in the region between the nasal cavity and the maxillary sinus. Usually the base of its crypt is at a slightly higher level than the floor of the nasal cavity, and so located that it is braced against the solid bone at the lower border of the malar process.[5]

As the crown proceeds occlusally, additions to the root end occur in this comparatively remote and stable area. Thus, in the full development of the longest root provided any tooth, the cuspid's apex is surrounded by dense bone in a region which is able to resist the environmental forces that influence the position of the crown. Two principles are involved: (1) the greater the depth of its anchorage the greater also is the immunity of a tooth to bodily displacement; and (2) the opportunity for a crown to deviate from its normal eruptive course increases in proportion to the distance it must travel from its area of development to full occlusion. In maintaining a relatively fixed position the apex acts, for all practical purposes, as an immobile center of rotation. Any change in crown position on eruption is therefore an increase in the inclination of the tooth as a whole, with the apex remaining behind in the position originally intended for it. In contrast, teeth which develop comparatively close to the surface do not have, in the shorter and more direct distance they need to travel, as great an opportunity for directional deviation as that of the deeply placed cuspid.

The time element in eruption is another etiologic factor to be considered in cuspid deviations. These are the teeth that are normally late in eruption and are, therefore, the ones most likely to be deflected from a normal course because they are exposed for a longer period to environmental conditions which may be unfavorable. The cuspid is the last of the permanent teeth to erupt which is preceded by one of the deciduous teeth. Unlike premolars, which replace teeth equal to or greater than their mesiodistal widths, the cuspid follows a slender deciduous tooth which is by no means capable of maintaining sufficient space for its permanent successor. As it erupts, it is also competing for space with the second molar, which ordinarily is due to appear at about the same time. And finally, it has to wedge itself in between other permanent teeth already established in the dental arch, and these earlier erupting teeth may have ap-

propriated for themselves part of the space originally reserved for the cuspid. Disturbances in growth of any of these parts may cause complications ranging from only a slight increase in its mesial inclination to its being completely blocked out of the dental arch (Fig. 7).

In its inclined plane relations with the lower teeth, moreover, the cuspid's single pointed cusp receives very little of the occlusal force that acts to influence the roots of the upper posterior teeth (Fig. 8). Upper molars, for example, have broad, horizontal surfaces which occlude with similarly constructed lower

Fig. 5. Fig. 6.

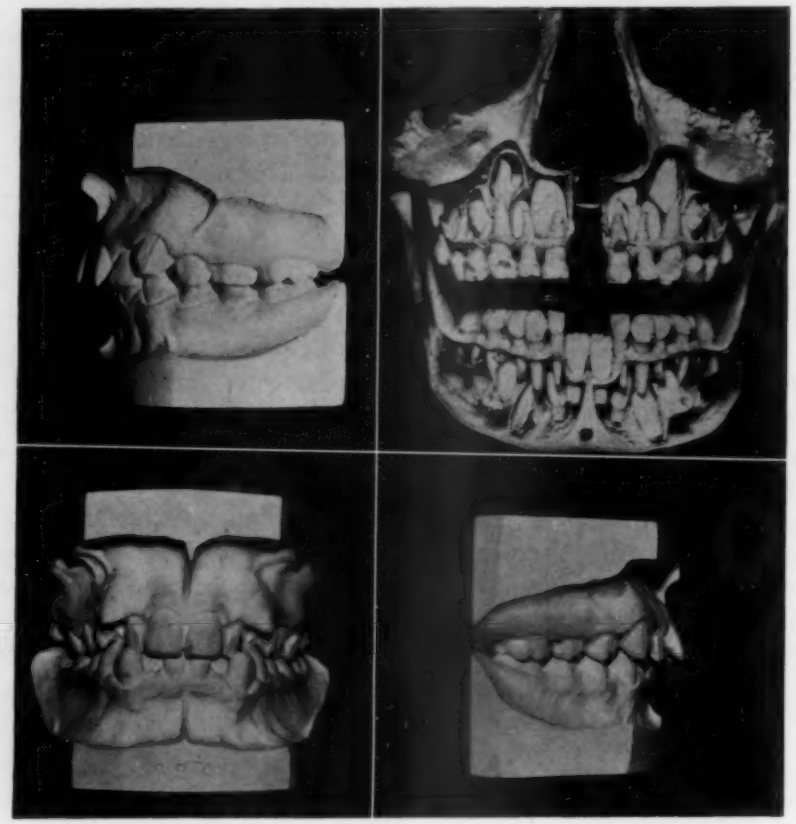

Fig. 7. Fig. 8.

Fig. 5.—Excessive mesial inclination of the upper left cuspid, as disclosed by the contours and long axis of its crown, and by the outline of the canine eminence in the alveolar process. The extent of the mesial displacement of the first premolar, second deciduous molar, and the first permanent molar can be visualized by mentally repositioning the cuspid distally to its normal crown inclination.

Fig. 6.—Cuspid crowns calcify at much deeper levels than other permanent teeth and are preceded by smaller deciduous teeth. This influences their time and direction of eruption and often permits other permanent teeth to occupy part of the space originally reserved for the cuspids in the dental arch. (From Noyes, Frederick B.: Dental Histology and Embryology, ed. 4, Philadelphia, 1929, Lea & Febiger.)

Fig. 7.—Cuspids completely crowded out of the arches present marked degrees of axial inclination. The incisors have maintained their positions directly over the alveolar ridge. Clinically, it appears that all posterior teeth are located mesially to their normal positions in the dental arches.

Fig. 8.—The tapering inclines at the tip of the upper cuspid crown produce during function little or no mesial movement of the cuspid apex. But the apices of the roots as well as the crown tend to move mesially when an upper molar is displaced because the force of occlusion falls for the most part on its distal marginal ridge.

molars. As a result of functional stress, these opposing surfaces tend to maintain upper posterior teeth in an upright position. When an upper molar starts to tip mesially, the force of occlusion falls for the most part on its distal marginal ridge. Following the principles of leverage, this ridge acts as a fulcrum or point of resistance which constantly tends to re-establish the long axis of the tooth in the direction of the line of occlusal force. This force does not wait until the tooth is fully tipped; it starts to work at the first sign of tipping. Consequently, the apices of the roots as well as the crown tend to move mesially when an upper molar is displaced.

In contrast, the tapering inclines at the tip of the cuspid crown produce during function little or no mesial movement of the cuspid root. Under these conditions, the apex fails to receive the persistent stimulation to move from its comparatively stable base in a manner similar to that encountered by teeth with broad occlusal surfaces at right angles to their long axes. Instead, any occlusal force tends to aggravate cuspid tipping without reacting on the root apex because it is delivered to slanting inclines at the tip of the crown. Since this increase in its angle of inclination is relatively constant and persistent, the position of the upper cuspid in malocclusion provides a more accurate picture of tooth shifting than do molars and premolars.

This analysis is particularly significant when considering bimaxillary conditions involving a probable malposition not only of the one tooth but also of entire segments of dental arches. If marked mesial inclination of the upper cuspid indicates mesial crown displacement, and if the posterior teeth have maintained contacting relations among themselves and with the cuspid as well, it follows that the molars and premolars also must have moved mesially, whether or not they exhibit perverted mesioaxial inclinations.

If, on the contrary, the cuspid crown presents the almost vertical position ordinarily associated with normal occlusion, then all of these teeth may be assumed to be in normal mesiodistal relation to facial and cranial anatomy. A possible exception exists when unusually strong lip pressure pushes distally on the tip of the cuspid crown.[6] If it does so with sufficient force, it may offset the perverted mesial inclination by causing the apex also to move forward. Under these conditions, the tooth acts as a lever in response to opposite pressures—one caused by eruptive forces in a mesial direction, the other by lip pressure in a distal direction. It is remotely possible that this force may also be relayed through the lateral incisors in Class II, Division 2 malocclusions. This reaction creates the illusion of a normally inclined cuspid because the tooth once again presents an upright position, when, as a matter of fact, the entire tooth has been bodily displaced because of this unusual combination of forces.

AXIAL INCLINATION OF THE LOWER CUSPID AND ADJACENT TEETH

Most of these diagnostic conclusions on the size, position, form, and eruption of the upper cuspid apply also to similar malpositions of the lower cuspid. It also erupts late, has a long root and a single tapering cusp, is preceded by a smaller deciduous tooth, and competes for space in the dental arch with other

permanent teeth either in full occlusion or which are about to erupt. Although its area of development is not as deep as that of the upper cuspid, it is still deeper than that of the other lower teeth. All of these things determine its course of eruption and its resultant axial inclination just as they do with the upper cuspid.

There is, however, one important difference in the environment of the lower tooth which is not present in the upper arch (Fig. 9). The lower cuspid is located in an arch which is confined within the upper arch when the teeth are in occlusion. If the upper cuspid tends to move mesially, only lip pressure is present to restrain it. The lower cuspid encounters the additional restraint of upper teeth closing downward and inward during functional occlusion. Since this occlusal force is also active on the lower cuspid's approximating teeth, the lateral incisor and the first premolar, the entire series is jammed together in such a manner that all three can and should be combined as a diagnostic unit when teeth are in malocclusion.

The lower cuspid in particular occupies a critical position of a keystone nature at the junction of the anterior and posterior segments of the dental arch (Fig. 10). It seems to be an area of weakness in arch design in which characteristic symptoms of disturbance are first located. In the lower arch, these symptoms of malocclusion are indicated not only by a change in the inclination of the cuspid, but also by the character of the break in contact relations on either side of the tooth. This break in arch continuity occurs as frequently in the vertical plane as it does in the horizontal and can be detected by a closed bite and an excessive curve of Spee as well as by the more easily recognized crowding of teeth buccally, labially, and lingually out of normal arch alignment.

Shortening of arch length results in either case.[7] Since the widest point mesiodistally in all teeth is located between contact points, total arch length is greatest when normal proximal relations are universally maintained (Fig. 11). Reduction in arch length occurs when contacts slip or buckle from any cause to narrower portions of adjacent teeth.

When it occurs in the vertical plane it is characterized by depressed and elevated teeth, which in turn are associated with and typical of an accentuated curve of Spee. These reactions are somewhat more complicated with lower teeth than with upper teeth, and are due apparently to differences in the curve of Spee in the two arches—concave in the lower arch and convex in the upper arch. Because of its concavity, any increase in the lower curve is accompanied by a depression of the premolars. This may be caused by posterior teeth attempting to move mesially or by inadequate growth of anterior teeth in a forward direction. In either case the premolars are caught between opposite forces. Because they are also located near the center of the curve of Spee and hence below the direct line of force, the resultant pressure on these teeth is of a wedging nature in a gingival direction.

If the cuspid and its adjacent teeth retain normal inclinations, then a simple depression of the lower premolars appears to be responsible for the reduction in arch length and the excessive curve of Spee. When a tooth slips

below the contact points of its neighboring teeth, it requires less space because teeth are narrower below their contact areas than they are at those points. Symptoms of collaspse in small arches, therefore, seem to be centered in the first premolar region, for, in this arrangement, the premolar's mesial contact, for example, is below the cuspid's distal contact on a smooth, sloping surface which narrows down as it tapers or converges gingivally.

Fig. 9. Fig. 10. Fig. 11.

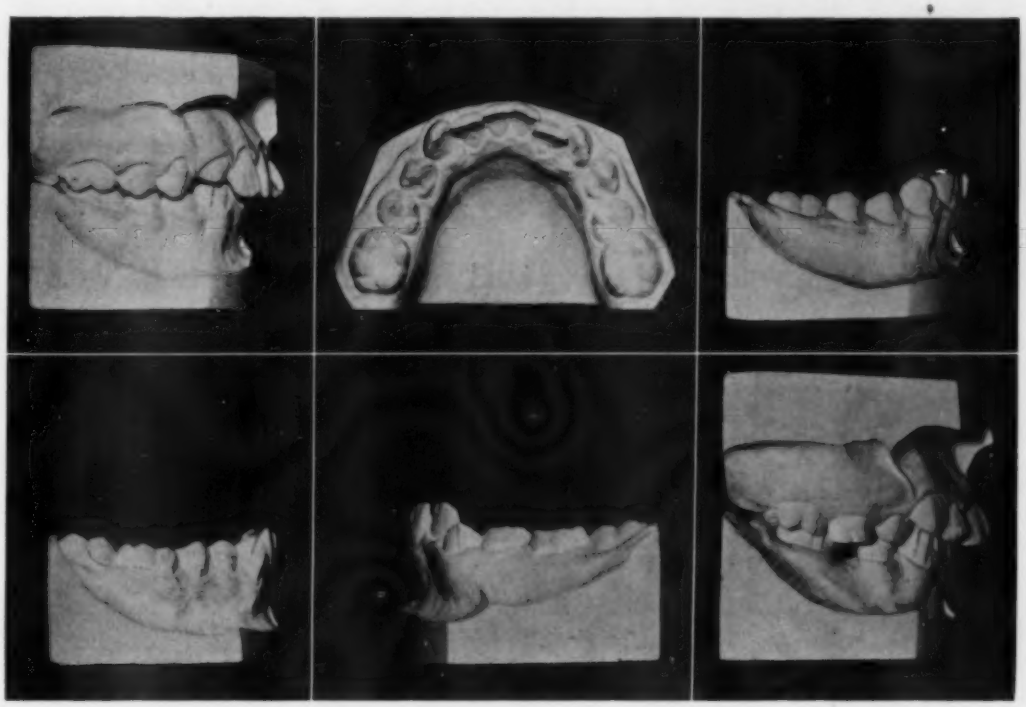

Fig. 12. Fig. 13. Fig. 14.

Fig. 9.—The lower arch is confined within the upper arch during occlusion, which permits upper teeth to influence the position of lower teeth in malocclusion.

Fig. 10.—Symptoms of collapse in the lower arch center around the cuspid and its adjacent teeth, the lateral incisor and first premolar.

Fig. 11.—Reduction in arch length from molar to lateral incisor occurs when contact areas slip as a result of an excessive curve of Spee.

Fig. 12.—Marked mesial inclination of the lower cuspid indicates a mesial migration of all teeth distal to it since contacts have been maintained throughout the posterior segments of the arch.

Fig. 13.—Deciduous molars are wider mesiodistally than the succeeding premolars. The cuspid has erupted ahead of schedule; hence has been forced to occupy a position mesial to normal.

Fig. 14.—Mesially inclined cuspids and lower first molar reveal a mesial displacement of all posterior teeth.

If these teeth are also tipped mesially, there are additional complications. As the first premolar tips forward, its mesial contact area lowers slightly and thus is even farther down on the converging distal surface of the cuspid. Arch length is thereby reduced by that much more. The cuspid, moreover, when it tips mesially, often slips labially past the lateral incisor (Fig. 12). Lacking proper contact, the lateral incisor may even drift lingually from its normal position overlying the alveolar ridge, and, as it does, erupt further incisally. In this manner there is created a closed bite, reduction in arch length from the

mesial of the first molar to the distal of the lateral incisor, and a greatly accentuated curve of Spee. The acknowledged tendency of teeth to move mesially, whether from a force component, tooth design, muscular pressure, or apposition of bone, is in great measure the cause of the crushing pressure which in turn is responsible for the depression, elevation, and tipping of teeth in the lower arch.

Although this difference in arch length may seem to be minor in degree, it is in fact extensive considering that several teeth may be involved and that the ideal treatment is a difficult distal movement of posterior teeth which now requires not only tipping the molars, premolars, and cuspid back, but also gaining additional space for wider contact areas.

The sequence of eruption of the cuspid and premolars is the same in both arches, but it seems to deviate more often and to cause more complications in the lower arch than it does in the upper arch (Fig. 13). Normally the first premolar erupts first, then the second premolar, and finally the cuspid. This pattern is more important than the age of eruption. Frequently the order is reversed and the cuspid precedes both premolars. Deciduous molars, however, are wider mesiodistally than the premolars that replace them, especially in the lower arch. Because of this, they are able to deflect the cuspid mesially from its normal direction of eruption, the extent of which can be determined by the resultant mesial inclination of its crown and by unfavorable changes of a crowding nature in the position of the incisors. On the ultimate loss of deciduous molars, moreover, there is no particularly active force to reposition the cuspid back where it belongs (Fig. 14). In fact, the lower first molar will migrate forward much more rapidly than the cuspid will move distally, for it is normal for it to do so on the loss of the deciduous molars. In this manner, all posterior teeth tend to tip forward in order to maintain full contacting relations with the mesially displaced cuspids.

Emphasis is also placed on the lower lateral incisors because these teeth are seen occasionally somewhat to the lingual of the central incisors and cuspids, but directly overlying the alveolar ridge (Fig. 15). Clinical evidence alone gives us reason to believe that when these lateral incisors are maintained during treatment immediately above the ridge, the tendency for the characteristic orthodontic relapse in the lower anterior region is minimized or eliminated entirely.

A Class I diagnosis, for example, presupposes a reasonably well-developed mandible in its proper relation to cranial anatomy. If, because of perverted axial inclinations, it can be demonstrated that a mesial migration of the lower posterior teeth has occurred, the next step is to observe occlusal relations between the arches (Fig. 16). If apparently normal intercusping of the posterior teeth is found, and if it already has been established that the lower teeth have moved mesially, then obviously the upper posterior teeth also must have moved forward in order to maintain normal inclined plane relations, normal, that is, as far as mesially inclined teeth can provide. If, in addition, the lower lateral incisors remain erect and well located above the alveolar ridge, it may be assumed that, of all teeth, they are the most normally positioned in the lower arch. If

this premise can be accepted, the lower lateral incisors can often be used as a fairly reliable guide in determining the normal or abnormal positions of virtually all the rest of the teeth in the denture.

Problems in treatment then arise, for there is both clinical and roentgenographic evidence of the difficulty in successfully moving posterior teeth distally. Many of these comments on the lower lateral incisors also apply to the lower central incisors. They do not, however, seem to present the diagnostic possibilities of the lateral incisors in their more direct or closer approximation with the lower cuspids.

None of these clinical observations of one area is made independent of other areas. If, for example, it has been determined that upper posterior teeth have moved forward because of occlusal relations with mesially displaced lower teeth, further evidence will be found in the upper arch to confirm this analysis made from the lower teeth. Unfortunately, extraction of teeth all too often appears to be the most satisfactory compromise in many of these bimaxillary conditions, but every possible diagnostic measure must first be exhausted in an effort to determine if it is the only course that can be followed.

Fig. 15. Fig. 16. Fig. 17.

Fig. 15.—Lower lateral incisors often retain positions directly above alveolar ridge, which probably means that they alone, of all teeth, are the most normally located in the dental arch.

Fig. 16.—Excessive mesial inclination of lower cuspid indicates mesial displacement of lower posterior teeth. Since normal occlusal inclined plane relations persist, upper posterior teeth also have moved mesially.

Fig. 17.—Lower cuspids tip distally almost as often as they tip mesially. Marked deficiency in supporting structures is illustrated by the perverted inclinations of virtually all teeth.

The lower cuspid, moreover, does not always tip mesially when in malocclusion; almost as frequently it presents the direct opposite—a distal inclination (Fig. 17). The upper cuspid rarely tips distally. When extreme in the lower arch, it presents problems in treatment which are possibly greater than when the tooth is mesially inclined. The lower cuspid often is elevated as well as tipped distally. The lower first premolar usually presents a definite mesial inclination, and occasionally has the appearance of being forced gingivally back to its point of origin. The incisors may be crowded, erect, or lingually inclined, and are usually elevated. These conditions in combination again create a closed bite and an excessive curve of Spee. As a whole, the lower arch appears to be retarded in development, particularly in the anterior region. The deviation ranges from

the moderate, almost vertical, cuspid to the extreme, depending on the extent of the muscular perversions which are usually associated with the condition (Fig. 18).

Although careful consideration must be given to all cases with slightly irregular lower anterior teeth, the condition need not be overemphasized unless it reflects symptoms of marked malocclusion elsewhere in the denture. The reasons are not clear, but a moderate amount of crowding of the lower anterior teeth is possibly characteristic and typical of the human dentition (Fig. 19).

Fig. 18.

Fig. 19.

Fig. 18.—Distally inclined cuspid of a more moderate nature than that illustrated in Fig. 17.

Fig. 19.—Nonorthodontic normal lower arch illustrating balance of supporting structures but with a slight labial displacement of the central incisors.

It may be only a single rotation of a lower cuspid, or just a slight break in contacting relations between two incisors; nevertheless, relatively few nonorthodontic normal occlusions present perfect alignment of the six lower anterior teeth. It must be remembered, moreover, that as age increases and in spite of an unfavorable outlook for such an irregularity, these six lower anterior teeth are usually among the last to be lost from any cause, whether crowded or not. Further evidence of the persistence of this typical irregularity may be seen in the moderate relapses that occur occasionally even in cases in which extraction has been a necessary and basic part of treatment. Obviously, further advances in orthodontic knowledge are necessary if it is to be eliminated entirely.

ROTATION OF THE UPPER FIRST MOLAR

A diagnostic aid in analyzing mesial movement of upper posterior teeth is the characteristic rotation of the upper first molar that usually accompanies its forward displacement (Fig. 20). The upper first molar is probably the most defamed tooth in the denture, in that its so-called immobile or stationary position has been referred to so often. This tooth in fact reacts to forces causing displacement almost as readily as any other in the dental arches. Every orthodontist has seen its occasional mesial migration on the premature loss of a second deciduous molar. But as it moves forward it tends to rotate, and, in so doing, it provides a diagnostic symptom that is not particularly characteristic of any other tooth.

This tendency to rotate is due for the most part to the anatomical contour of the large mesiolingual cusp of the upper first molar. This sturdy cusp occludes firmly in the central fossa of the lower first molar. This relation is so effective and unyielding that it resists mesial movement of the upper first molar as a whole. Instead, the mesiolingual cusp acts as a center of rotation, causing the mesiobuccal cusp to turn lingually as it moves mesially. Since the strong lingual root of the first molar is also located in a favorable position, it very likely assists in a similar manner by offering more resistance to displacement than the two shorter buccal roots combined.

The upper first molar is rhomboidal in form and wider buccolingually than mesiodistally (Fig. 21). This means that its greatest diameter is not through the contact areas, but instead on a line extending diagonally across the tooth from the distolingual cusp to the mesiobuccal cusp. These are also the cusps that become the contacting areas when the upper first molar assumes its characteristic rotation. Consequently, more space is required between adjacent teeth when the upper first molar is rotated than when normal contact relations are maintained in the dental arch.

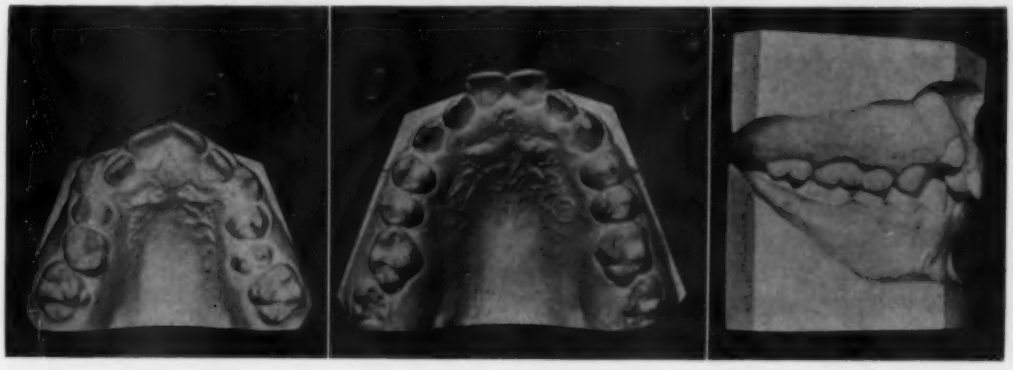

Fig. 20. Fig. 21. Fig. 22.

Fig. 20.—Mesial migration of posterior segments is confirmed by rotated first molars and mesially inclined cuspids.

Fig. 21.—Rotated upper first molars require excessive space because they are wider across their occlusal surfaces from the mesiobuccal cusp to the distolingual cusp than they are between contact areas.

Fig. 22.—The mesial inclination of the upper cuspid indicates a mesial displacement of the upper posterior teeth into a Class II inclined plane relation in what otherwise is a Class I case.

In occlusion, this upper first molar rotation brings about an end-to-end cusp relation with the lower molar. If the forces causing this mesial movement are excessive, the mesiolingual cusp will also move forward far enough to produce a complete Class II inclined plane relation of the posterior teeth (Fig. 22). This condition would not change the orthodontic classification to a Class II malocclusion. It would still be classified properly as a Class I case, but with a mesial migration of the upper posterior teeth. With teeth in this relation, the full force of occlusion of the mesiolingual cusp falls on the mesial marginal ridge of the lower first molar, thus accentuating the mesial inclination of this lower tooth.

Herein lies a further observation: a mesial movement of lower posterior teeth often carries the upper posterior teeth forward to the same extent and degree as that of the lower teeth. But a mesial displacement of the upper posterior teeth does not mean that the lower teeth will as effectively move forward with the upper teeth. These mesially displaced upper teeth, moreover, will not usually show the degree of mesial tipping that occurs in the lower arch; they tend to move forward bodily more than do lower teeth, as described earlier in this paper. This may be due to the greater resistance offered by the broad mesial surfaces of the roots of the lower molars, in contrast to the cone-shaped roots of the upper molars, and to a probable difference in the character of the alveolar bone in the two arches. It is also possible that the downward curvature of the curve of Spee in the lower arch may be responsible in part for this reaction.

OTHER CLINICAL SYMPTOMS OF MALOCCLUSION

There are, of course, many other intraoral indications of malocclusion and retarded development that can be observed at random from day to day in clinical practice. For example, another symptom of mesial migration of upper posterior teeth is the early eruption of the upper second molars (Fig. 23). In these cases, they erupt not only ahead of their normal schedule, but also before the lower second molars which ordinarily are due to erupt first. If other symptoms are also present, such as rotated first molars and insufficient space for unerupted cuspids, then this early eruption of the second molars contributes to the conclusion of a diagnosis of a mesial migration of the upper posterior teeth.

Confirmation of this clinical assumption seems to come from unilateral malocclusions, wherein the upper second molar erupts early on the side of the arch showing the greatest mesial drift (Fig. 24). It has been observed, for example, in Class II subdivision conditions in which the upper second molar on the Class II side has erupted not only ahead of its lower antagonist, but also well in advance of the other upper second molar on the opposite side of the arch presenting normal occlusal relations with the lower teeth. When this occurs, it may be suspected that a mesial migration of the upper molars and premolars is associated with if not actually the cause of the Class II condition on the affected side.

Apparently, the second molars in these cases are permitted or encouraged to erupt early because the first molars have made it possible for them to do so by moving mesially, thus clearing the way for their early appearance. In other words, the second molars are not held back while waiting for normal growth to create sufficient space at a later date for their regularly scheduled emergence into the dental arch. If this assumption is correct, then only cephalometrics can determine the effect that early mesial movement of teeth and premature eruption of second molars have in retarding growth of the deeper supporting structures of the area. In the meantime, it is reasonable to suspect that full development of posterior alveolar structures is not achieved in the absence of the stimulating influence of normally positioned teeth, both erupted and unerupted.

Anterior teeth also are useful in confirming clinical decisions based on the mesial displacement of posterior teeth. If molars and premolars move forward, obviously they will require part of the area reserved for the incisors. These anterior teeth may simply crowd together in overlapping positions, with one or more forced into labial or lingual malpositions, or they may persistently maintain their normal positions overlying the ridge and thus crowd the cuspids completely out of the arch (Fig. 7). In typical Class II, Division 1 conditions, the incisors assume distinct labial malpositions, with a probable associated displacement of the entire alveolar arch mesially on its maxillary bony base. But in Class II, Division 2 cases, the upper central incisors may so effectively maintain their ideal positions directly on the crest of the alveolar ridge that they alone, of all teeth, are the most normally located in the upper arch (Fig. 25).

Fig. 23. Fig. 24. Fig. 25.

Fig. 23.—Mesial migration of the upper first molar permits the early eruption of the second molar. The mesial displacement of the upper posterior teeth is confirmed by the mesial inclination of the upper cuspid.

Fig. 24.—Compare with Fig. 23. Since the right first molar is more mesially positioned than the left first molar, earlier eruption of the right second molar is permitted. As is frequently the case, the previous rotation of the right first molar has been reduced in degree by the eruptive force of the second molar.

Fig. 25.—The central incisors in this Class II, Division 2 case appear to be located in their normal positions directly on the crest of the alveolar ridge. It is probable that they are the most accurately located of all teeth in the arch, and that all other upper teeth are anterior to their normal positions.

Evidence of crowding of teeth in deficient arches, moreover, is not necessarily limited to the incisor area alone; posterior teeth also show similar symptoms by certain characteristic malpositions, sometimes even in cases in which the anterior teeth remain relatively well aligned. How else can it be explained why third molars erupt normally in sturdy, well-developed arches, yet become impacted in arches that do not quite reach their full growth. Or that lower first molars occasionally rotate, distal surfaces lingually, to be followed by second molars emerging late and buccally or lingually to normal arch alignment. Most likely these posterior teeth, like the incisors, are simply crowded out of proper alignment in arches that fail to achieve their full size and development.

Contrary to upper molars, space is lost when lower molars rotate in this opposite direction. The lower first molar is wider mesiodistally than buccolingually, which means that its greatest diameter is located between contact

areas. Its mesial surface tapers lingually from its buccally placed mesial contact, and its distal contact is centered somewhat lingually to the well-rounded contour of its slight distal cusp. These converging mesial and distal outline forms permit the rotated lower first molar to occupy a shorter space between adjacent teeth than is required when contact areas are normally positioned. Occasionally, the lower second molars fail to achieve full eruption, but remain partially submerged with only the mesial cusps exposed. Although the cause of this posterior crowding is not fully known, it is possibly an indication of retarded development of posterior supporting structures—anteroposteriorly in the case of the rotated first molars, and vertically when teeth achieve partial eruption only.

CEPHALOMETRIC ASSISTANCE FOR THE EXPERIENCED CLINICIAN

It has been the purpose of this discussion to show that a thorough understanding of the various changes in the positions of teeth is an orthodontic requirement of the greatest importance, no matter what diagnostic methods are favored otherwise. These intraoral signs and symptoms are a basic part of clinical analysis. If they told the full story of malocclusion they would, of course, be sufficient. But these changes in the inclination of teeth are also symptoms of disturbances in growth of structures that often are quite remote from the teeth and the alveolar process, and which are properly in the province of cephalometrics. Facial photographs, although not a part of this paper, provide considerable assistance clinically in appraising these deeper areas, but soft tissues conceal the important bony landmarks. Unoriented headplates also fail to disclose all the required information, for they are usually distorted and of little use for serial purposes. In the absence of measuring the skull itself, cephalometric roentgenology is the most accurate substitute in determining structural deficiencies far removed from the teeth, and in a few ways is superior to actual skull measurement.

This is particularly true with the deceptively simple but nevertheless difficult borderline cases in which an error in diagnosis means failure in treatment. These are the cases that test the skill of the orthodontist, and are, therefore, the ones for which cephalometrics offers the greatest promise in verifying the judgment of the experienced clinician. But its use is not limited to the borderline cases. Many of the marked facial deformities are also in need of cephalometric analysis to determine the best method of procedure in order to arrive at the most favorable compromise in treatment. Facial norms, various ideal angles, and standard measurements already have been determined in the several centers active in cephalometric diagnosis. Although there are different approaches to the problem and differences in interpreting the evidence provided by the headplates, the fundamental principles are sound and worthy of universal acceptance in orthodontics.

But the application needs far more than casual study of what to date has been published in the literature. Organized study is the proper solution and, if there is to be uniformity and standardization, it can be provided only by those

who have had the tenacity of purpose to develop this modern approach to orthodontic diagnosis. The experienced orthodontist is aware of the need for this additional knowledge, and, in the interest of the patients he is obliged to serve, by some means it must be made available to him.

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708 CHURCH STREET.

CONGENITAL AGLOSSIA

A Case Report

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A 22-YEAR-OLD man of Chinese descent came to the Washington University Dental Clinic with the complaint of pain in a lower anterior tooth. He was five feet tall and weighed one hundred twenty pounds. His general appearance was one of alertness. He answered questions intelligently, but with a definite speech impediment. He was a second-year college student in a school of engineering, and a later check of his scholastic standing revealed that he was in the upper one-third of his class. This was only his second visit to a dentist, the first one being when he was much younger, and at which time he thought he had had one or two lower anterior teeth extracted.

The entire lower portion of his face was greatly underdeveloped, and the chin was noticeably receded. In speaking, the buccinator muscles were very noticeable in their movement, as were the muscles of the floor of the mouth. Also in speaking there was a clearly audible intake of air, and a tendency for saliva to escape from the corners of the mouth.

Clinical examination revealed the absence of a tongue, with no rudimentary structure resembling a tongue. The floor of the mouth was smooth and could be elevated to contact the incisal edges of the maxillary anterior teeth. The maxillary arch was constricted and triangular. Using Pont's Index as a norm, there was a maxillary contraction of 19 mm. in the premolar area, and a 11 mm. contraction in the molar area. The maxillary lateral incisors were in extreme linguoversion, with a supernumerary tooth in the midline just anterior, between the central and lateral incisors. In the mandibular arch there was a molar contraction of 16 mm., and a molar contraction of 11 mm. The mandibular central and lateral incisors and the right cuspid were missing. It was necessary to extract the left mandibular cuspid, due to an acute pericementitis caused by the shearing bite.

Bimaxillary relationship was one of extreme mandibular retraction with buccoversion of all left maxillary teeth. The occlusion on the right side was limited to that of the maxillary second molar with the mandibular first and second molars.

Dental radiographs showed the presence of unerupted maxillary and mandibular third molars, all of which appeared to be impacted. There was a generalized marginal alveolar atrophy, this being advanced around the molar teeth.

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The gingival tissue was atrophic, and the gingival crevice was exaggerated around all the teeth. The mouth was clean, and never during the time he was seen was there any clinical evidence of an exudate from the exaggerated crevices. There was cervical caries on the mandibular right first premolar and occlusal amalgam restorations in the mandibular right and left first molars, and the mandibular left second molar. There was no other evidence of caries.

Fig. 1. Fig. 2.

Fig. 3. Fig. 4.

Fig. 1.—Full face.
Fig. 2.—Left profile.
Fig. 3.—Anterior view, occluded gnathostatic models.
Fig. 4.—Posterior view, occluded gnathostatic models.

In testing for the four qualities of taste sensations, 3 per cent cane sugar, 1 per cent sodium chloride, 0.1 per cent sulfuric acid, and 0.1 per cent quinine were used by moistening a small camel's-hair brush with the solutions and applying this to various regions of the mucous membrane of the oral cavity. The only area in which the taste sensations could be distinguished was on the surface of the soft palate.

He was the eldest child of a family of eight children, three of whom had died in infancy, and the others, according to him, were well. They were not available for examination, nor were his parents, but he explained that as far as he knew, they all had "sound" teeth. He stated that the absence of a tongue had caused him no undue concern, except in speaking and in eating certain dry

Fig. 5. Fig. 6.

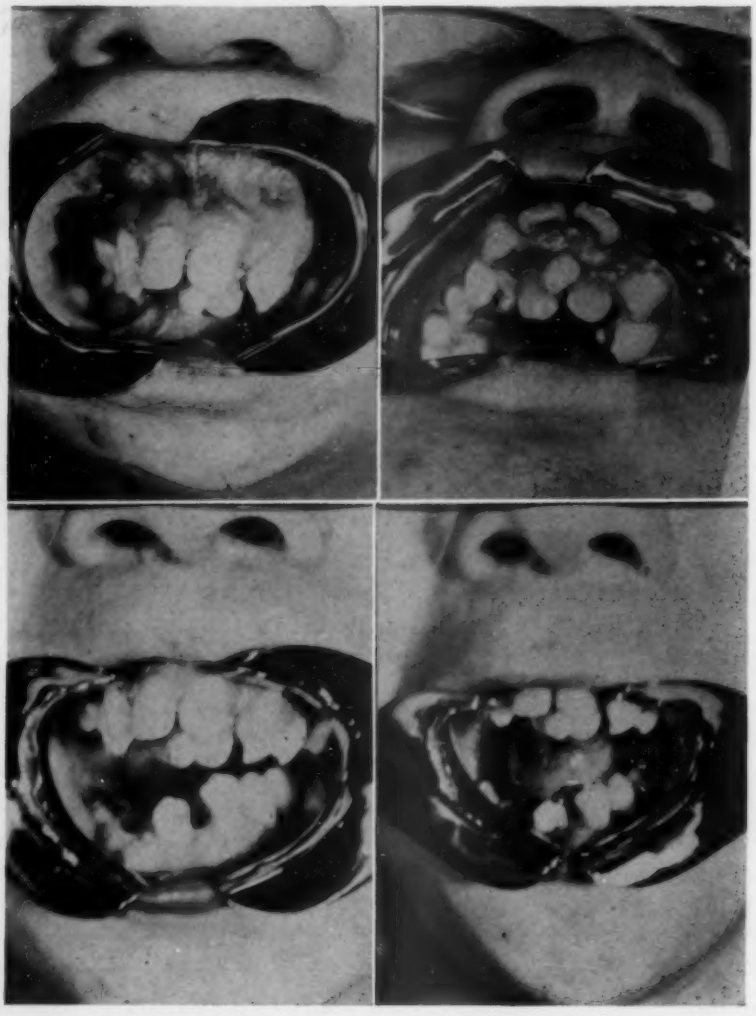

Fig. 7. Fig. 8.

Fig. 5.—Anterior view, teeth occluded.

Fig. 6.—Anterior palatal view; note lingually placed lateral incisors and supernumerary tooth in midline.

Fig. 7.—Anterior view of mouth; open-floor of mouth relaxed.

Fig. 8.—Anterior view of mouth; open-floor of mouth elevated to touch incisal edge of maxillary anterior teeth.

foods, such as cereals and breads, which would often lodge in his palate and would have to be removed with his finger. His parents had considered malformity a "curse," and he had not sought professional advice before his clinic admission, except on one other visit to a dentist when he was younger.

He speaks both Chinese and English. He was examined at the speech clinic at the Central Institute of the Deaf, and the following analysis of his speech was made:

All consonants of the English language with the exception of "P," "B," "M," "F," "V," "W," and "Sh" require contact of tongue with teeth if they are to be made clearly. It would seem impossible, then, with the absence of tongue muscles, to produce such sounds as "T," "D," "N," and "L," which are made with the tip of the tongue contacting the alveolar process directly behind the upper front teeth, also the "K" and "G" which require a contact of the dorsum of the tongue with the palate. Regardless of this, the speech of this boy is intelligible.

It requires analysis to determine what compensation he is making to approximate these speech sounds. For instance, when he wishes to say the "Th" which is normally made with the tongue slightly protruded and resting on the upper front teeth, he takes instead the position for "F," which has a similar sound but changes the position of contact of teeth and lips slightly so that a differentiation is made between the "F" and the sound he substitutes for "Th." For the production of the "K" he contacts the buccinator muscles with the molars as a substitution for tongue and palate contact. He makes the same compensation for "Ch" controlling his breath stream so that there is a difference between the "K" and the "Ch." But while it makes an acceptable "K" or "Ch," it also influences the clarity of the voice. He makes the "T," "D," and "L" sounds by elevating the floor of the mouth to contact the anterior maxillary teeth. The intelligibility of these sounds depends upon their combination with other sounds in the word.

The vowels are not so difficult to produce, since they are made with an open throat. While they are modified by the changing positions of the tongue, they are also modified by changing positions of the cheek muscles and mouth aperture. He says most vowels clearly with the exception of the long "A" and long "E," which require a forward muscle of the tongue. On close analysis these substitutions can be detected, but they do not deviate so widely from the normal as to make his speech unpleasant. His inflection, his expression, and his rate of articulation are normal. His voice is well pitched, but not projected, and it has a muffled and somewhat mushy quality.

With such anatomical abnormality, it is remarkable that the speech of this subject does not deviate more conspicuously from the normal. He has done exceptionally well in atuning his ear to normal speech and developing and substituting corresponding sounds in his own speech.

DELETERIOUS RESULTS OF UNDUE STRAIN IN THE JAW AREA

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INTRODUCTION

MODERN dentistry has long recognized the significance of slight (continuous or intermittent) forces in determining the position and the displacement of teeth; it has diagnosed their pathologic results and taken into account their therapeutic effect in juvenile orthodontics accordingly. In this connection we can mention Oppenheim's[1] law that it is not only the magnitude of the force but, above all, the duration of its effect that is decisive. Thus an apparently minor malocclusion, untreated in the early childhood, will frequently manifest its obnoxious results only at a later age, around the thirtieth year.

In the denture of the adult we have failed to pay adequate attention to forces relatively small, yet acting for long periods of time. Hence we have failed to recognize the genesis and failed to prevent the impending danger of certain polymorphous pathologic conditions, such as susceptibility to caries, diseases of the gums, neuralgia of the trigeminus, or affection of the temporomandibular joint. The effect on the denture of marked attrition or of its complete absence, or of tilted teeth, or of premature loss of teeth has frequently been underestimated. These conditions result in disharmony in other parts of the denture, which, in turn, may lead to various local disturbances.

DISRELATION BETWEEN JAW AND TEETH

The phylogenetic studies of Adloff,[4] Boule,[2] Bolk,[3] and others show that the decrease in number and size of the teeth does not correspond to the retrogressive development of the human jaw from primordial times to the present. The originally massive jaw has become much smaller and weaker, whereas the changes in regard to the size and number of teeth were on a smaller scale.[4]

This means that we may encounter teeth of Neanderthal dimensions in our patients, and thus we get disrelations on a phylogenetic basis. The Heidelberg jaw surpasses the modern one in length by 40 per cent, and in thickness by 50 per cent to 100 per cent. The teeth too have undergone a certain reduction, but only by 5 per cent to 10 per cent (Berger[5]).

Congenital absence of the germs of the third molars, occasionally also of the upper lateral incisors, or of the second premolars has become more frequent in modern man.

This frequent disproportion between the size of the teeth and the structure of jaw may explain why relatively slight anomalies often lead to rather severe disturbances. The structure of the maxillary bone is not always adequate for the teeth embedded in it, and thus an inherent pathogenous force may cause its rapid deformation and atrophy.

Read before the Palestine Dental Conference at Jerusalem, May 20, 1946.

STRESS AND RELAXATION

Orthodontics realized first the importance of the effects on the masticatory apparatus of physiologic and pathologic forces, using the former therapeutically and eliminating the latter. The effect of mechanical forces can generally be determined with accuracy. But in the case of the denture, where the forces act on living tissues, the problem is not merely a mechanical but a biomechanical one, i.e., it is in direct relationship with the biologic factor. During mastication and speech the muscular force is transferred by the teeth to the surrounding tissues. In the normal jaw the forces are balanced. The axial active masticatory forces and the resisting forces of the supporting tissues are in equilibrium. But even in this case there appear horizontal components in addition to the forces acting axially.* "The teeth are suspended in the socket by the periodontal fibers in such a way that pressure forces exerted against the tooth will normally be translated into a traction force."[6] This translation, however, takes place only in the case of axial forces, and even there only on the wall of the socket, but not on its bottom. Nonaxial pressure forces, i.e., the horizontal components, are not, or only partly, translated into traction forces, but transmitted on the bone in the form of pressure. This explains the susceptibility of the alveolar fundus to excessive axial forces and of the alveolar wall (particularly of the alveolar margin) to excessive horizontal pressure forces.

As long as the degree and duration of these forces remain within the physiologically admissible limits, that is, depending on the biologic factor, no changes or damages will occur. In this connection it is essential to emphasize that during the rest period, when no forces are acting, the stress on the tissues is relieved and a process of restoration and nourishment takes place.

In the case of malposition of the teeth and malocclusion, or of a mutilated denture, when the forces act on a single tooth only (Fig. 1) or on a group of teeth (Fig. 2), there is a disturbance in the direction of the forces as well as in the point of exertion, thus exceeding the physiologically admissible limits and leading to overstrain. The periodontal tissue which serves as a cushioned hammock ligament[7] is thus liable to be destroyed. This destruction brings about direct contact of tooth and bone and the direct transmission of forces from one hard surface to another which, in the long run, leads to resorption of the alveolar margin and sometimes even of the tooth itself.

Forces, normally admissible in regard to their strength, may become pathogenic by the *duration* of their exertion. Permanently acting forces do not allow any relaxation in the affected tissue, nor any reparation where damage has already occurred.

The need for, and the biologic significance of, relaxation was long ago realized by Bates in the field of ophthalmic therapy, and by Gottlieb in our special subject. Bates based his therapy on an adequate strain and relaxation of the eye, thus succeeding in restoring normal sight to many injured eyes without help of glasses. In insisting on the jaws always being kept slightly open, except during meals, Gottlieb[6] recognized the same principle long ago. In this

*Note explanation in the last section of this article.

manner he achieved not only a greater protection of the mandibular joint, of the teeth, and of the periodontium, as well as better blood circulation in the tissue, but also a psychic influence. The grinding and clenching of the teeth are familiar expressions of psychic tension. Slightly opened rows of teeth prevent facial tension and influence even the psychic correlation which leads to the facial expression. Just as psychic emotion involuntarily takes on a muscular expression (frowning of the forehead, laughing), so muscular tension acts upon the psychic state of a person. Our therapeutic principle is healing through elimination of improper strain. However, the pathologic forces do not permit this.

Fig. 1.

Fig. 2, *A*.

Fig. 2, *B*.

Fig. 3.

Fig. 1.—Stress on a single tooth.
Fig. 2.—*A*, Stress on groups of teeth. *B*, Juvenile denture.
Fig. 3.—Susceptibility to caries.

THE TILTED MOLAR

We may still ignore the origin of every pathologic force. One phenomenon, however, whose effect, as it seems, has escaped attention, constitutes the central subject of this study. This single factor which may give rise to a multitude of pathologic consequences of undue strain is the tilted molar. Several phenomena for which no definite cause has so far been found, such as certain neuralgic symptoms, certain cases of alveolar pyorrhea, certain nonconstitutional defects in the enamel, susceptibility to caries (Fig. 3), hypersensitiveness of entire groups of teeth, the unphysiologic migration of teeth, all these have been found to be due to the presence of one or more tilted molars. This view is confirmed by numerous clinically observed cases, of which a selection will be given later.

The molar may have become tilted either as a result of its own malposition or owing to imbalance from the loss of its adjacent tooth and its tendency to find contact with the next tooth. In the case of a tilted tooth, its axis forms an angle with the direction of the masticatory force. The greater the degree of inclination, the greater the horizontal component of the masticatory force, and vice versa, thus resulting in a vicious circle. If the tilted tooth achieves contact with its medial neighbor, the transfer of the increased horizontal force to the adjacent tooth becomes possible. It adds up to the horizontal component of its neighbor's masticatory force which has so far been within physiologic limits. The adjacent tooth, on the other hand, is now subjected to the effect of an increased horizontal force that has in this way assumed a pathogenous character resulting in damage of the periodontium, resorption of the bone, and of the tooth itself, tipping or wandering in a medial direction. This process continues from tooth to tooth, and in the course of time the result may become general medial tipping or wandering, leading even to diffuse atrophy. Whether the tilted molar is in the upper or in the lower jaw, its obnoxious effects appear mainly in the upper jaw due to the difference in structural strength between the maxilla and the mandible. On the other hand, the lower tilted molar being as it is buttressed by the ramus and linea obliqua, its deleterious effects are more severe. Thus we see that *the tilted molar is responsible for the increased forward migration of the teeth, and hence for a considerable malocclusion.* The dental arch has some similarity to a stone arch; the load exerted upon the vertex of such an arch is transferred from stone to stone and absorbed by the two lateral resistant buttresses. In the case of the dental arch the (horizontal) forces take the opposite direction: from the lateral parts, the molars, toward the anterior teeth which form the vertex of the arch. The front teeth, however, have, generally, the relatively weakest buttress, as will be shown later. Therefore, any increase of the forces acting from the molars will affect the anterior teeth in a more or less serious way.

In the case of a deep overbite and a very flat dental arch mostly in the mandible with crowded teeth, the transfer of the forces from tooth to tooth may be interrupted. The foremost tooth, subject to the influence of the mesial trend of the tilted molar (e.g., the first premolar in Fig. 4) will then be pushed out of the alignment in a linguo- or buccoversion, whereas the teeth in front of it will remain unaffected. Thus we see that in the case where the vertex of the arch, i.e., the anterior teeth, is capable of resisting an increased force applied by the molars, this additional force will express itself in the displacement of the premolars.

Tweed maintains that "the mandibular incisor teeth must be positioned on basal bone to be in functional mechanical balance, and that this position is the normal one for these teeth."[8] The same importance should be attributed to the axial position of the molars, i.e., to the mesially tilted teeth.

The variety of pathologic symptoms resulting from or influenced by the syndrome of the tilted molar can hardly be overrated. We shall try to classify them into four principal groups:

The first group of symptoms comprises the phenomenon of pyorrhoea alveolaris with diffuse atrophy, and an open-bite with protrusion of the front teeth.

Its predisposing condition is the presence of strong teeth with high cusps, deep grooves, and hard enamel, restricting lateral movement of the mandible and therefore offering great resistance against functional wear, while the power of resistance of the alveolar bone is smaller and therefore inadequate. Should a mesially tilted molar add itself to such a denture, an injurious effect on the supporting tissue, especially on the alveolar margin, will be caused owing to the augmented horizontal component of the masticatory force. The horizontal force is transferred from tooth to tooth, increasing continually. Gradually the periodontium loses its capacity of resistance on account of this enduring pressure. The lateral teeth, embedded with several roots, become tilted, but the round single root of the anterior teeth yields to the unilateral pressure, and, following the line of least resistance, tilts outwardly, thus forming an open-bite. Thus the picture of protrusion of the front teeth and diffuse atrophy is obtained, which would otherwise remain a puzzling phenomenon, since no occlusion seems to affect the teeth concerned. Diffuse atrophy, hitherto always attributed to constitutional causes only, has thus found another explanation.

Fig. 4, *A*.

Fig. 4, *B*.

In the cases of an open-bite and crowded teeth, the oblique direction of axes arises from the strain imposed on the tissues by the tilted molar. This tension may prove to be an additional cause of the open-bite (not caused by rickets), and therefore any attempt at selective grinding of the posterior teeth only, in dentures of adults, is not sufficient. A relapse should be expected within a few months, the only permanent relief consisting in the elimination of the cause.

The second group of symptoms appears in cases of combination of a strong and healthy jawbone, structurally deficient teeth (with defective enamel and deep grooves), and presence of a tilted molar, conditions which are accompanied by deep overbite and crowded teeth. As the deep overbite on the one hand and

the tilted molar on the other hand hinder any anterior and posterior movement, the pathologic force does not cause a migration of the teeth, but affects the teeth substance itself. This may lead to acute sensitiveness of the area concerned, enamel defects, and cervical notches on the same level of the particular group of teeth or dentine exposed by marked attrition. In certain cases of extremely crowded teeth, resorption may take place at the neck of the tooth (Fig. 3). As a consequence atrophic disturbances may ensue, affecting the dentinal substance from within and causing its decalcification.[9] Kornfeld has shown that "decalcification in its turn causes a reduction of volume, and shrinkage of the dentine matrix, which as pulled away from the inner surface of the enamel, causing spaces to exist between it and the dentine.[10] Gottlieb showed by photomicrographs that caries can develop along a lamella into the dentine and that it progresses along the paths of the prism sheaths,[11] thus leading to caries susceptibility, changes, and even necrosis of the pulp.

The third group of symptoms appears in the presence of a tilted molar and a cross-bite with a marked deviation of the median line, caused mostly by upper canines standing in linguoversion. The consequence is excessive stress on the group of teeth affecting them and the temporomandibular joint. If the cross-bite is unilateral, one side is in disuse, and the consequence is observed mainly on the second side, which alone can be used for mastication. The gliding movement of the mandible is rendered more difficult or restricted. The tipped molar gives rise to changes in the occlusal plane causing functional disability; these changes are increased in the case of premature loss of teeth or of a mutilated denture. Furthermore, while the temporomandibular joint has a certain power of adaptability to the articulating occlusal plane, the additional forces released by the tipped molar cannot be borne by the joint to an unlimited extent, either in time or degree, and they may, gradually, lead to arthritis, subluxation, and similar complaints; while, if the abnormal stress is transmitted from the displaced mandible to the meatus auditorius externus, deteriorated hearing or tinnitus (Costen's syndrome) may result.

The fourth group of symptoms are caused by the presence of an excessive locked bite and tilted wisdom teeth without antagonist which are elongated beyond the occlusal plane due to continuous active eruption. The elongated wisdom teeth represent an obstacle for any gliding movement and hence leave only the possibility of opening and closing the jaws in vertical direction. As neither the joint nor the jaws are generally suited for this kind of mastication, this occlusion has a traumatic effect. The nerves in the segment concerned are irritated through false pressure, and neuralgic pains result.

Similar conditions are caused by extremely narrow and underdeveloped jaws which often lead to an impaction of one or several teeth. As known, an impaction of teeth causes a pressure on the fifth cranial nerve and thus leads to neuralgia often of a severe degree.

The treatment of this polymorphous syndrome cannot be confined to render the tilted molar harmless; relief must also be found for the injuries already caused by its faulty position. As the treatment must conform to the symptoms of the disturbance, each group and its treatment shall be described separately by a number of typical cases.

CASE REPORTS

Group I

CASE 1.—The patient was a 40-year-old woman.

History.—Her history revealed a gradual loosening of her teeth with the gums strongly inflamed and bleeding. All attempts to cure this condition, from an apparently unknown cause, had failed, and the process had continued in an aggravating course.

Status Praesens.—Examination revealed a narrow jaw and crowded teeth. The maxillary incisors, strongly protruding, hindered the closing of the lips. Inspection of the mouth revealed a marked mesially tilted lower wisdom tooth which had served as a bridge abutment being put in a locked bite. Moreover, the second lower left molar was mesially tilted too, occluding only with its distal edge. The pulp of the right maxillary incisor had died owing to the traumatic occlusion. The mesially tilted lower molars had caused the tipping of their antagonists in the same direction, and the pressure transferred by the affected teeth had produced the labial tipping of the upper incisors which had led them to their fan-shaped position. The lower incisors had loosened and become elongated because of the developed open-bite. The natural consequence of this continuous pressure was hyperemia, general inflammation of the gums, and breakdown of the alveolar bone. (Fig. 5.)

Symptoms.—Marked alveolar pyorrhea and diffuse atrophy.

Treatment.—The bridge was replaced by another one which was correctly constructed and which restored the axial position of the right lower wisdom tooth; a normal occlusion plane was established; the lower left second molar was set upright with the aid of an onlay. The interfering cusps were reduced through selective grinding. The upper incisors were retracted by means of a bite plate provided with a labial arch of stainless steel. The occlusion was stabilized and the teeth became firm. This treatment proved satisfactory from both the clinical and the esthetic point of view.

CASE 2.—The patient was a 35-year-old woman.

Status Praesens.—Examination revealed narrow dental arches with protrusion of the upper front teeth and open-bite. The lower wisdom teeth were mesially tipped. The rest of the dentition presented sharp intercuspation which resulted in a marked locked bite. The upper posterior teeth, including the canines, were tipped mesially. The upper central incisors were loosened, elongated, and displaced through diffuse atrophy. Mastication was hampered. (Fig. 6.)

Symptoms.—Pyorrhea alveolaris of the third degree with impending loss of the teeth.

Comment.—The tilted wisdom teeth together with the crowded teeth and the ensuing locked bite exerted pressure resulting in strain, tipping, and loosening of the posterior teeth, and displacing of the upper front teeth labially.

Therapy.—Extraction of the lower wisdom teeth. Normal mastication was restored through spot grinding of the interfering cusps. A bite plate with a labial arch, worn at night only, was inserted in the maxilla. Normal occlusion and normal facial expression were restored.

CASE 3.—The patient was a girl, 18½ years of age.

Status Praesens.—Examination revealed a narrow dental arch and a small basal bone with protrusion and spacing of the maxillary incisors. Inspection of the mouth revealed the premature loss of the right first molar and the consequent mesial tilting of the right second molar in the maxilla. The second premolar was in mesioversion. In the mandible the wisdom teeth were congenitally missing and the extraction of the left first molar had resulted in the mesial tipping of the second molar. The premolars on the same side had rotated and migrated in posterior direction resulting in the fanwise spreading of the front teeth.

The occlusion on this side was a locked bite while on the opposite side it showed cross-bite. There was also a deep overbite present, and the median line was displaced to the left.

Symptoms.—Extremely advanced alveolar pyorrhea and diffuse atrophy in the upper front teeth.

Fig. 5.

Fig. 6.

Fig. 7.

Comment.—The injury of the denture which is unusually severe considering the patient's youth, and which did not respond to any local and surgical treatment, can be explained by bilateral locked bite due to the tilted molars, the deviation of the lower jaw, and the deep overbite. Any lateral movement of the lower jaw is hindered and the lower incisors push their antagonists labially. (This explains the diastemas in the upper incisor region.)

Treatment.—The arch was expanded and the bite was raised, while the upper incisors were retracted by means of a bite plate with a labial arch of stainless steel. The interfering cusps were reduced by grinding while the missing teeth were replaced by fixed bridgework which at the same time fixed the occlusal height. The condition has greatly improved, although the treatment has not yet been fully completed.

NOTE.—This anomaly (protrusion of the front teeth and diffuse atrophy) which shows invariably the same complex of symptoms has been described in three cases as the result of tilted molars and extremely crowded teeth.

Group II

CASE 4.—The patient was a 23-year-old man.

Status Praesens.—In the maxilla on the right side the first premolar, first molar, and wisdom tooth, and on the left side two premolars were missing. In the mandible on the right side the second premolar and the second molar, and on the left side the second molar were missing. The right upper second premolar was rotated, tilted mesially, and had elongated below the occlusal plane. The lower wisdom tooth on the same side presented the same condition (tilting and elongation). There was a deep overbite. (Fig. 7.)

Symptoms.—The elongated teeth, together with the deep overbite, led to a locked bite and prevented the gliding movement of the lower jaw. Only vertical movements were possible. Labial (enamel) defects at the cervical part of the upper front teeth; hyperaestesy and enamel erosion in a progressive stage. The affected teeth were already discolored.

Comment.—The traumatic effect of this pathologic condition was the predominant cause of the enamel defects. Had the alveolar bone been less resistant, alveolar pyorrhea and diffuse atrophy would have occurred instead of the damage of the tooth substance.

Treatment.—Our clinical experience showed us that filling of the enamel defects alone would not be sufficient in this case, since the processes would continue in spite of the fillings as long as the cause was not removed. The only therapy which gave us satisfactory results consisted in grinding the affected teeth accordingly, and in raising the bite and replacing the missing teeth by bridgework in order to restore the normal occlusal plane.

CASE 5.—The patient was a 50-year-old man.

Status Praesens.—Deep overbite. The lower wisdom teeth were elongated and mesially tilted, while their mesial edges occluded with the distal edges of the second upper molars. The lower front teeth were strongly abraded by mastication.

Symptoms.—Mastication became ineffective and difficult owing to muscular hypotony. The molars were hypersensitive. Pulp involvement was found in the upper right second molar and the lower right central incisor. There was marked marginal congestion and inflammation of the gums.

Comment.—The oblique occlusal surface of the lower wisdom teeth acted as an inclined plane to the upper molars. Owing to this condition and the deep overbite, the movements were restricted, on the left side stronger than on the right, because the left lower wisdom tooth, being more tilted, forced the mandible to deviate to the right. The lower right central incisor stood in labioversion, and consequently the median line was shifted to the right.

Treatment.—The extraction of the lower wisdom teeth and the grinding of the interfering cusps were followed by the construction of a bite plate worn at night only. This treatment resulted in the raising of the bite and the shifting of the lower jaw back to centric occlusion.

CASE 6.—The patient was a 28-year-old man.

Status Praesens.—There was premature loss of the first molars in the lower jaw. The second molars were strongly tilted mesially and occluded only with their distal edges. Deep overbite and distoclusion completed the clinical picture.

Symptoms.—The lower incisors were protruding. Rampant caries was responsible for the partial destruction of the dentition. Fig. 8 shows changes in the coronary pulp of the right canine in the lower jaw.

Comment.—The combined effect of the tilted molars, the deep overbite, and the distoclusion which obstructed the masticatory movement formed the predisposing cause of the rampant caries.

Treatment.—The strongly injured teeth were extracted and the remaining ones restored through conservative treatment. Prosthetic appliances were inserted to establish a new occlusal plane and to restore the biologic function of the remaining teeth.

Fig. 8.

CASE 7.—The patient was a 43-year-old man.

Status Praesens.—Examination showed genuine overbite and distoclusion. In the maxilla the six-year molars were tilted while the first and second molars on the right side and the second premolar and first molar on the left side were extremely elongated, thus disturbing the occlusal plane. In the mandible the missing first and second molars and second premolar on the left side were replaced by fixed bridgework. (Fig. 9.)

Symptoms.—There was marked loss of tooth substance in the incisor regions of both jaws through abnormal wear, almost reaching in the enamel-cement junction with dentine exposed. The pulps of the teeth had undergone regressive changes, the teeth having thereby lost their sensitiveness to physical agents.

Comment.—The present bridgework is ineffective, having been constructed without taking into consideration the pathologic conditions. On the contrary, they have fixed the malocclusion. The badly deformed occlusal plane was not improved either. The steplike intercuspation due to the bridgework does not allow lateral movements of the mandible. The ultimate result of this restriction of movements is the exaggerated attrition of the anterior teeth.

Treatment.—The elongated upper posterior teeth were shortened, and effectively built bridges were inserted into the mandible in order to raise the bite and to restore the normal occlusal plane. The anterior teeth were functionally and esthetically restored by means of jacket crowns.

Group III

CASE 8.—The patient was a 40-year-old woman.

Status Praesens.—The maxillary right second and third molars were mesially tilted owing to the early loss of the first molar. The mesially tilted left third molar was moreover elongated and in linguoversion. In this faulty position it was fixed in a bridge. The canine on the right side was in linguoversion too. In the mandible the anterior teeth were strongly tipped lingually and their labial surfaces were abraded to a considerable extent. The right canine was in labioversion. The median line was deviated to the right. This was a case of genuine overbite accompanied by locked bite caused by the strong intercuspation on the right side and the elongation of the left upper wisdom tooth. (Fig. 10, *A* and *B*.)

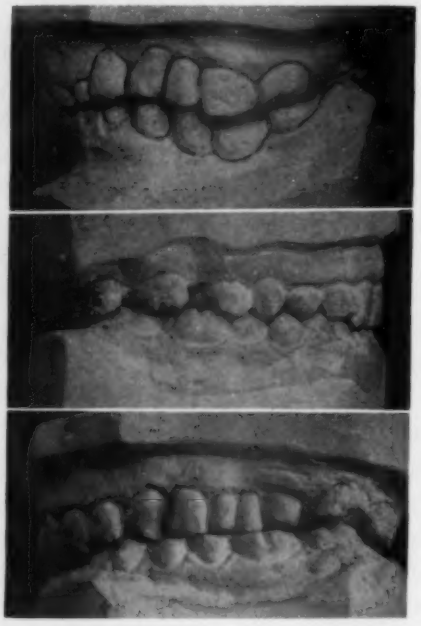

Fig. 9.

Fig. 10, *A*.

Fig. 10, *B*.

Symptoms.—Gingivitis, incidental habitual luxation, and facial neuralgias on the left side, accompanied by deterioration of hearing.

Comment.—In this case the overbite and the locked bite would not have been sufficient in themselves to produce these serious injuries. It needed the additional malposition of the right canines and the molars, which, by forcing the mandible to the left, gave rise to the previously mentioned complaints. The deteriorated hearing resulted from the pressure the condyle exerted on the anterior wall of the outer meatus of the ear.

Treatment.—The bite was raised; the elongated and the tilted molars and the cross-bite were corrected by suitably constructed fixed bridgework. A bite plate worn at night only was provided with stainless steel springs whose action resulted in the normal alignment of the anterior teeth. The condition was considerably improved.

CASE 9.—The patient was a 30-year-old man.

Status Praesens.—Examination revealed crowded teeth in the maxilla. The right wisdom tooth was in bucco-mesioversion. The left canine was in linguoversion. A fixed bridge extended on the left side from the second premolar to the wisdom tooth. In the mandible the third right molar was strongly tilted mesially and fixed in this faulty position by a bridge extending to the second premolar, while the left canine was in labioversion. The median line was deviated to the left. There was also a marked overbite.

Symptoms.—Continuous loud noises in the ear any treatment of which had completely failed.

Comment.—The pronounced distal cusp of the lower right second molar articulates with its antagonists (the second and third molar) in a locked bite. This frequently observed anomaly was intensified in this case by the cross-bite of the left canines. Owing to the locked bite the mandible had been deviated to the left, and its condyle constantly pressed against the outer meatus of the ear, hence the disturbances in hearing.

Treatment.—The correction of the cross-bite by raising of the bite through fixed bridgework resulted only in a partial improvement of the patient's condition. Tentatively the right upper wisdom tooth was then extracted and the result was the complete disappearance of the symptoms.

Group IV

CASE 10.—The patient was a 46-year-old man.

Status Praesens.—Examination showed a mutilated dentition in the maxilla. The missing teeth were replaced by a partial denture. The molars on both sides were elongated except the right wisdom tooth which was arrested in its eruption by its elongated antagonist. The compensation curve of Spee was exaggerated. In the mandible the right wisdom tooth was elongated and mesially tilted. The first and second molars were shortened through marked abrasion. On the left side there was a fixed bridge extending from the left first premolar to the wisdom tooth which was strongly tilted mesially and elongated. The elongation of the tilted wisdom teeth in the mandible and the deformed occlusal plane resulted in a locked bite. (Fig. 11, *A* and *B*.)

Symptoms.—For twelve years the patient had complained of continuous pains on the left side of his face, neck, and chest. These chronic troubles were mistaken for heart disease and treated accordingly with no success whatsoever.

Comment.—The removal of the left lower bridge, owing to caries under the crown of the wisdom tooth, alleviated the general symptoms surprisingly. The history revealed that the beginning of these symptoms coincided with the insertion of the bridge. The pain was caused by the strain produced by the malconstructed bridge causing a locked bite. The right lower wisdom tooth might have permitted the mandible some freedom of movement, but the mesially tilted left lower wisdom tooth, fixed in the bridge, made any anteroposterior movement impossible. Hence the pains concentrated on the left side and led to these symptoms which spread far beyond the area usually concerned.

Treatment.—The lower wisdom teeth were ground to normal height. New bridges were constructed and established the normal axial inclination and com-

pensation curve, and thus prevented any further strain. Following this treatment two years ago, all symptoms entirely ceased and no relapse was reported by the patient since.

CASE 11.—The patient was a 38-year-old woman.

Status Praesens.—Following the extraction of the right lower and left upper wisdom teeth, their antagonists erupted beyond the occlusal plane. The mandible presented extremely crowded teeth with marked displacement of the left second premolar. There was deep overbite; the median line shifted to the right. Owing to the elongated right upper and left lower wisdom teeth, a locked bite developed which, together with the deep overbite, rendered any gliding movement in an anterior or posterior direction impossible. The locked bite was aggravated by extensive bridgework, thus preventing any possible physiologic movement of the affected teeth. (Fig. 12, *A* and *B*.)

Fig. 11, *A*. Fig. 11, *B*.

Fig. 12, *A*. Fig. 12, *B*.

Symptoms.—The patient complained of frequent attacks of migraine over a long period of time which incapacitated her for work during the attacks which used to last several days.

Treatment.—The left lower wisdom tooth was extracted and ground down to the normal height of the right lower molar. The upper fixed bridge, which consisted of fourteen elements, was removed and replaced by a partial denture. The bite was correspondingly raised. The immediate effect of this treatment was a considerable decrease of the intensity and vehemence of the neuralgic pains. A year later all symptoms had completely vanished.

CASE 12.—The patient was an 11-year-old boy.

Status Praesens.—He was suffering from allergic asthma. The maxilla was strongly underdeveloped and the jawbone was too small for the size of his teeth. There was no space between the first premolars and molars on both sides. This prevented the second premolars from erupting. The mandible was normally developed. The anterior teeth protruded and led to mesioclusion.

Symptoms.—Spontaneous neuralgic headaches occurred on both sides of the head, for unknown causes. Although examination by a specialist and x-rays

of the skull yielded no result, brain tumor was suspected because all the anti-neuralgic remedies applied were unsuccessful. Three weeks after the onset of strong persistent pains, I was consulted. The x-ray taken (Fig. 13, *A* and *B*) showed that the extremely crowded bite prevented the eruption of the canine, second premolar, and second molar on the right side and the second premolar on the left side. The extreme strain caused by this condition in the jaw was the only reason for the severe pains. This was proved by the fact that after the extraction of the upper first premolars the patient was completely relieved of his pains.

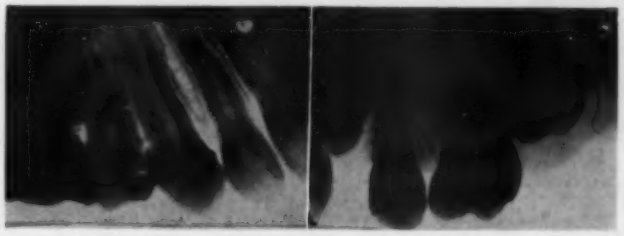

Fig. 13, *A*. Fig. 13, *B*.

Case 13.—The patient was a 12½-year-old girl.

History.—She had had severe neuralgic headache (migraine) attacks for seven years, chronic otitis for two years, and frequent attacks of angina and colds. Quartz rays and sea baths recommended by physician slightly improved her condition.

Status Praesens.—Underdeveloped maxilla. The anterior teeth protruded with diastemas. The left lateral incisor was congenitally missing. In the mandible the width of the arch measured from premolar to premolar is 8 mm. broader than in the maxilla. The anterior teeth were elongated and protruded. The right premolars were rotated by about 45°. There was distoclusion and cross-bite of the right molars; right molars in buccoversion and in the front region, open-bite. Median line shifted to the right.

Comment.—The cross-bite and the rotated premolars on the right side produced a locked bite, while the anterior teeth were out of occlusion. Also the strong intercuspation on the left contributed to a constant abnormal strain. Special attention should be paid to the disproportion between the broad, strong mandible and the frail, small maxilla. All these factors led to a pathologic condition of strain, manifesting itself in excessive headache. The shifting of the median line hints at the possibility of a negative influence on the chronic otitis.

Treatment.—Treatment in the maxilla consisted of expansion of the arch, retrusion of the anterior teeth, and broadening of the space of the missing left lateral incisor. Correction of the distoclusion, as well as of the cross-bite, was effected by orthodontic means. The mandible was thus released from the locked bite and shifted back to centric occlusion. The neuralgic pains disappeared after this treatment was completed.

CASE 14.—The patient was a 43-year-old woman.

Finally here is a complete case treated seven years ago which has remained stationary since. The patient had been suffering for many years from acute pyorrhea alveolaris with progressive loosening, particularly of the anterior teeth. There were crowding teeth in both jaws, tilted molars in the mandible, and deep overbite. Neither conservative nor surgical treatment of the gums could arrest the process. Relapses would occur after short intervals. (Fig. 14, *A* and *B*).

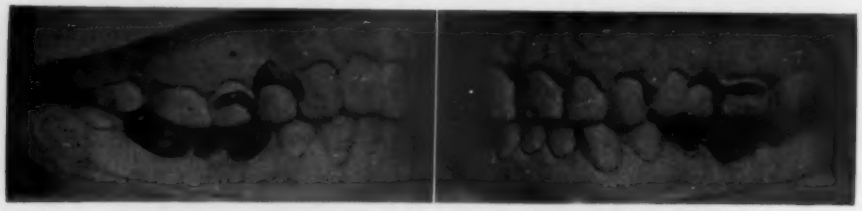

Fig. 14, *A*. Fig. 14, *B*.

Treatment.—The treatment consisted of selective grinding of the cusps, correspondingly raising of the bite by fixed bridgework in the lower jaw, and removable bridges in the upper jaw. This replacement, correctly constructed, led to balanced occlusion and effectively checked the process. This case is typical in its history and treatment, and is therefore chosen as an example.

The cases described here, selected from a large number, were successfully completed, and no relapse occurred. There is only one case still under treatment. The raising of the bite was performed with the aid of a one-sided temporary splint. It can be used for depressing of the opposite teeth too or correction of the deviation of the median line.[12]

CONCLUSION

The harmonious relation of forces in the healthy denture is characterized by the alternating play of pressure (mastication, occlusion) and relaxation. This relation is adversely affected by an additional strain occurring in an injured denture unrelieved by adequate relaxation. This will render the restoration of the tissue impossible. A tilted molar is among the main causes of additional pressure and excessive strain. In the tissue, the capacity of resistance is limited by the rate of resorption and that of apposition of the bone, both of which are individual. The rate of resorption of the bone can be influenced, but the rate of apposition is biologically conditioned. The two rates must be equal. If their equilibrium is disturbed, a process of destruction will begin. A proper treatment in time aims at influencing the rate of resorption. The diversity of treatment is the function of the diversity of anomalies, the treatment being designed to eliminate the causes which have produced the damage. However, it must be borne in mind that an obnoxious effect may sometimes continue even after the cause itself has been eliminated. Accordingly, the "inner resistance," i.e., the regenerative power of the tissue, will have to be supported

therapeutically. Consequently, each case of malocclusion or malposition of teeth should be treated and cured during childhood. However, as this is not always feasible, there will always be adult dentures with a wide variety of anomalies which have to be corrected prior to any prosthetic restoration.

In the case of a mutilated denture, therefore, it will not be sufficient to confine oneself to restore a defective tooth or replace a missing one; but the surrounding tissue and proper position of the neighboring, as well as of the occlusal, opponents must be first considered. Otherwise, the improvement achieved will only be of short duration. Hence it follows that in order to achieve an approximation to a balanced denture the procedure of the prosthetic restoration must be by successive stages and adapted to each case individually. In case of changes of the bite, study casts and photographs are required.

Disturbing cusps, teeth malposed, in faulty alignment, or partial loss of crown structure, with lacking normal proximal contact, must be rectified. A locked bite must be opened; otherwise this may lead to periodontal disease due to occlusal trauma. The elimination of malocclusion by orthodontic means will not be dealt with here.

With regard to the extremely important subject of the raising of the bite, we should like to point out that if performed incorrectly, it may have effects leading to damage in the temporomandibular joint, or to irritation in the trigeminus area. It is therefore advisable to raise the bite temporarily by means of a bite plate or of a splint, establishing the optimum height. Moreover, it must never be forgotten that the occlusion of the anterior teeth has to be secured by a slight mesial shift of the mandible if the desired effect is to be achieved.

SUMMARY

From the foregoing follows that an abnormal condition of strain in the jaws may produce a number of complicated disturbances in the teeth, their surrounding tissues, the mandibular joint, the auditory apparatus, and in the region of the trigeminus. We recognize the same cause—a tilted molar accompanied by locked bite or deep overbite—underlying several otherwise completely different groups of afflictions. For this reason, a causal treatment should devote special attention to any anomaly of this kind and treat it by the appropriate means.

1. Strongly interlocking cusps have to be reduced by selective grinding; tilted and elongated teeth or teeth with defective crown contour have to be removed or restored.

2. Locked bite or deep overbite has to be opened with the aid of a temporary splint, to obtain the desired vertical height as well as a satisfactory interarch relationship.

3. Missing teeth have to be replaced to establish correct contact relationship and to prevent tipping.

4. A deformed curve of Spee should be rehabilitated and centric occlusion restored, to guide the condylar head in proper anatomic condition.

5. The function of prosthetic appliances consists in transmitting onto the teeth, in axial direction, the more or less vertically acting masticatory forces as

well as in minimizing the transversal components. They must be so constructed as to allow free excursions of the mandible, thus increasing masticatory efficiency. Nor should the esthetic side be neglected.

Hence, in order to achieve the right diagnosis, essential to correct treatment, the dentist should possess at least a theoretical knowledge of orthodontics, for it is orthodontics that has the last word to guide him in his work.

THE EFFECT OF MECHANICAL FORCES PROCEEDING FROM A TILTED MOLAR*

The great variety in the shape of the teeth and their correlative positions, normal and abnormal, offers aspects so manifold with regard to the masticatory forces and their effect that any specific description can apply to only one particular case. If a more general description is intended, without being too complicated, it should be kept within a schematic form as far as possible.

The force of the masticatory muscles acts on the mandibular jaw, its direction being almost vertical. (The fact that the direction of the masticatory forces is not perfectly vertical does not make any material difference in what is explained further on; all it does is to increase the horizontal component in a slight degree.) This total force is subdivided into partial forces, which are also vertically directed, according to the number of pairs of teeth participating in the process of mastication. As certain teeth (molar) have, in occlusion, several contact surfaces, it would seem to be more correct to say that the total force is divided into partial forces according to the number of pairs of surfaces in contact during mastication. These partial forces are not equal in strength. They are strongest on the molars and smallest on the incisors.

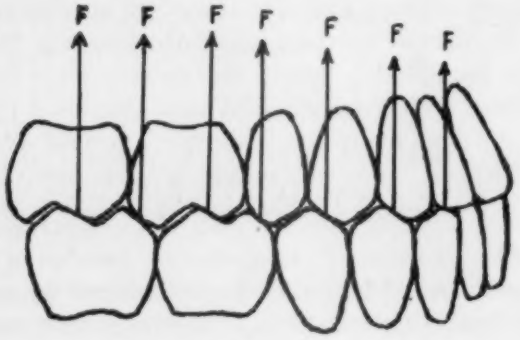

Fig. 15.

Fig. 15 shows, in a schematic form, two correctly built rows of teeth in a state of rest. The upper and lower teeth occlude only on the sloping surfaces rising in a distal direction. The surfaces *descending* in a distal direction do not occlude in this state. (It is known that these descending surfaces occlude only in the last phase of the mastication process when the mandible, after having risen, shifts slightly backward [A. Kantorowicz]. The partial masticating forces are designated as *F*.)

*Prepared with the assistance of Mr. I. Spitz, M.E.

If the teeth were not equipped with cusps and the surfaces of contact were horizontal and at right angles with the forces *(F)*, then the latter would merely push the lower teeth against the upper teeth. (According to the principle of mechanics—the principle of action and reaction—the upper teeth, too, press on the lower teeth with forces equal in strength to the forces [*F*], but in an inverse direction.) In fact, however, the surfaces of contact are inclined. In order to explain the effect of forces acting against inclined planes, they are broken up.

Fig. 16 illustrates the breaking up of force *(F)*.

The breaking up of a force is effected, as it is commonly known, in accordance with the law of parallelograms. The sides of the parallelogram are the component forces while the diagonal is the resultant force. According to this law, two components give one resultant, or one force will resolve into two component forces.

Let us, therefore, break up one masticatory force *(F)*, acting on one surface of contact, into two component forces, one of which *(S)* is parallel to the surface of contact, while the other *(N)* is perpendicular to the surface of contact. The force *(S)* (or, rather, all forces [*S*] obtained from all masticatory forces [*F*]) leads to a sliding or shifting of the mandible along the surfaces of contact in a distal direction. As already pointed out, this sliding represents the last phase in the process of mastication. The force *(N)* presses on the upper tooth, which transfers it to the maxilla. *If the direction of the force (N) were such as to pass along the root* or, in a more general way, if the force *(N)* were passing through the tilting point *(O)* of the tooth, it would merely result in pressure (chiefly transformed into traction) on the walls of the alveolus and the jaw bone, without any tendency of motion—shifting or tilting—of the tooth.

However, in general, the force (N) does not operate in the direction of the root and does not pass through the tilting point. Thus, in order to make it easier to understand the function of this force, it is again necessary to resolve it into two forces: one *(P)* acting in the direction of the root, or in the direction of the tilting point, and one *(H)* in a horizontal direction, forward. *P is a pressure force* and is transferred through the root (or through the roots) to the jawbone. *If the force (P) does not exceed its physiologically admissible degree,* it does not cause any undesirable effects. But it is known that there are many cases where *P* exceeds its limit of admissibility, resulting in an excessive load on individual teeth or groups of teeth, and, hence, in pathologic phenomena, particularly in the region of the roots.

The second component (H) tends to tilt or shift the tooth forward, or both tilt and shift it. Again, if the force *(H)* is not too great, i.e., if the specific pressure on the wall of the alveolus is not greater than it can safely resist, the tooth remains at rest. The force *(H)* and the resistant force *(R)* of the jawbone are balanced.

This balance is disturbed either by the fact that the resistant forces of the jawbone decline below the normal rate of resistance of a healthy bone, or by the rising of the force *(H)* above its normal degree. In the event of the influence of the force *(H)* exceeding the *resistability (R)* of the jawbone, *the differ-*

ence between these two opposing forces $(H' - R)$* shifts or tilts the tooth forward.

$$H' = H \cdot \frac{L}{1}$$

In the illustrations we shall see the two essential factors increasing the horizontal forces *(H)* and resulting thereby in a disturbance of the balance.

Fig. 17 again shows the breaking up of the masticatory force *(F)*, effected as in the previous figure. The strength of the force *(F)* is equal to that of force *(F)* in Fig. 16. However, in Fig. 17, the gradient of the surface of contact is *steeper* $(\alpha_2 > \alpha_1)$.

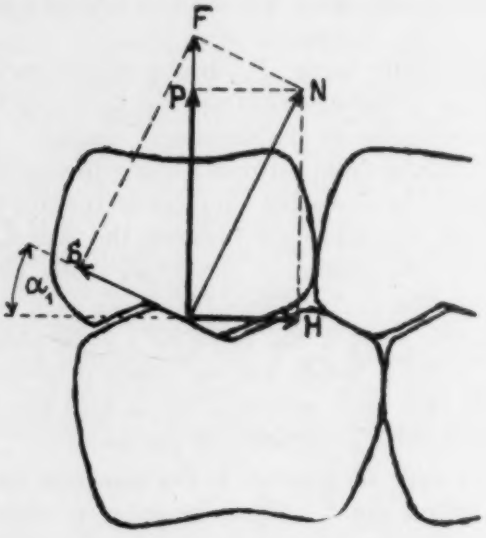

Fig. 16.

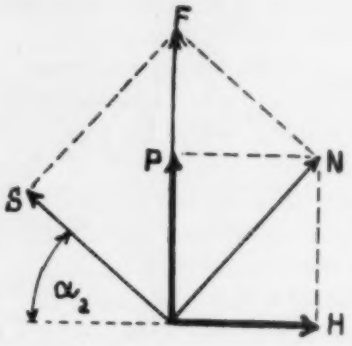

Fig. 17.

The figure shows the result clearly: the component *(H)* has grown considerably. The inference is: *the steeper the cusps of the teeth, the greater the horizontal forces,* and, conversely, the flatter the cusps, the smaller the forces *(H)*.

In Fig. 16 as well as in Fig. 17 the force *(N)* has been broken up in such a manner that the component *(P)* operates in the same direction as the force *(F)*. In other words, we have assumed that the upper tooth and its root are in an almost vertical position, and that the direction of force *(F)* passes through the tilting point. This probably is generally the case. However, in some cases the upper teeth, and in some others also the lower teeth, are inclined forward.

It may be asked, incidentally, whether it would not be reasonable to suppose that this forward inclination is caused by a continuous action through many years of the horizontal forces *(H)* acting on each tooth with sloping contact surfaces. Although the writer is not yet ready to assert this with complete certainty, this assumption seems to be correct.

*In order to reduce to a minimum the number of mechanical terms to be used, and to obviate, for example, the necessity of introducing the notion of the moment of force (H') is intended to designate here a force whose effect is equal to that of H and which counteracts R. (Fig. 19.)

Fig. 18, too, illustrates the masticatory force *(F)* and its breaking up. The strength of *F* has not changed. The only difference as compared with Fig. 16 is that in this case there is a mesially tilted molar in the maxilla. The direction of the pressure force *(P)* which is in line with the long axis of the tooth no longer coincides with the direction of the force *(F)*. It can be easily seen from the illustration that in spite of the fact that the force *(P)* has not changed, the horizontal force *(H)* has increased considerably in this case as well.

Thus, if, for either of the previously mentioned reasons, or for both, the horizontal force *(H)* becomes excessively great, the tooth will move forward and will be tilted or shifted.

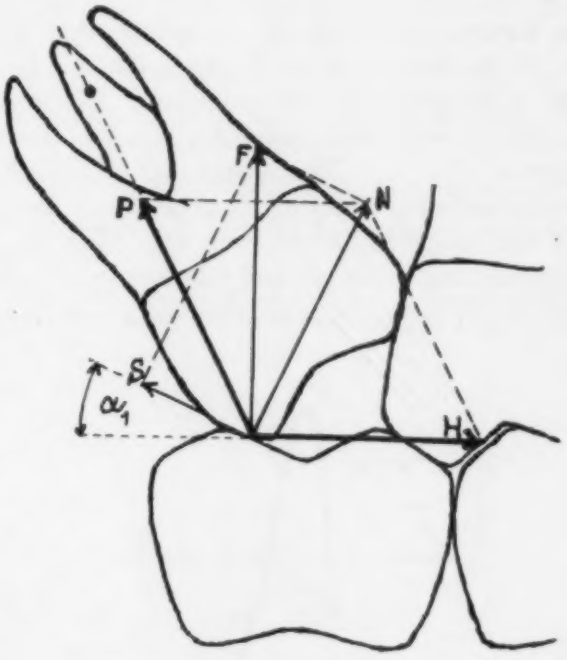

Fig. 18.

The case is similar when *the tilted tooth is in the mandible*. Here, too, the disturbance of the balance of the horizontal forces influences mainly the upper teeth, causing their forward movement. The difference *(H' – R)*, which arises from the tilted molar in the mandible and which acts in a horizontal mesial direction and *P* combined result in the mesially inclined masticatory force *(F')*. If, then, a mesially inclined (and even increased) force *(F')*, and not, as normally, a vertical force *(F)* acts on the maxillary antagonist, this will obviously lead to an augmentation of its horizontal component *(H)* with the effects described.

A tooth influenced by an increased horizontal force, if originally not in contact with its mesial neighbor, will shift toward it until such contact is effected. Then its excessive horizontal force *(H' – R)* will be transmitted to this mesial neighbor, and will add to its horizontal force, augmenting this force

until it, in its turn, exceeds the resistant force of this tooth, moving it until it gets into contact with its mesial adjacent. In this manner the process goes on from tooth to tooth until a general forward movement has been created.

$$(H'_7 - R_7) + (H'_6 - R_6) + (H'_5 - R_5) + \text{etc.}$$

$\longrightarrow 7$

$\longrightarrow 6$

$\longrightarrow 5$

Two more brief notes follow:

1. In our explanation we have assumed that all the teeth were at first in equilibrium *(H' = R)* and in a vertical position; and that an augmented horizontal force, as a result of the reasons set forth in Figs. 17 and 18 appeared in one tooth only. In the first stage of the *general* movement of the teeth, all the teeth were still in contact with their neighbors. In the course of time, the inclination increased more and more, attended with a simultaneous augmentation of the horizontal forces (Fig. 18). This means that each tooth in itself acquires, in the course of time and as a result of its greater inclination, a greater component *(H)* of its own, and frees itself, or is able to do so, of its dependence upon its distal neighbor, continuing its way forward by its own force, a development that may lead to the state known as atrophy alveolaris and, ultimately, to diffuse atrophy.*

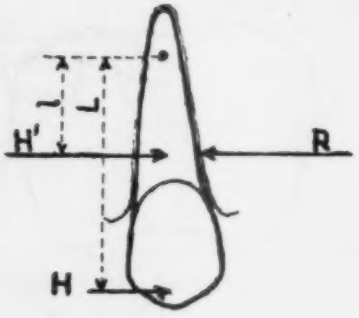

Fig. 19.

2. The second remark refers to the question why the inclination should be especially pronounced in the area of the front teeth, despite the fact that they are farthest away from the source of the phenomenon: The front teeth are apt to be affected by horizontal forces (particularly so in a labial direction), because of their shape, length, and their position in the jaw, and their resistant force *(R)* is smaller than that of the posterior teeth. The resistant force, i.e., the force by which the tooth resists, or is capable of resisting, being shifted or tilted, depends essentially on two things: on the specific strength *(K)* of the substance of the jaw and on the area *(A)* of the surface under pressure. $R = K \cdot A$.

*Gottlieb has described a separate form of periodontal disease as diffuse atrophy. This type is characterized especially by wandering of the teeth without showing the presence of causes which led to it.

It may be assumed that in a healthy bone structure the specific resistance strength is equal in all the teeth; $K_7 = K_5 = K_2 = K$; and R is proportionate to the area (A) of resistance.

$$R_2 = K \cdot A_2; \qquad R_5 = R \cdot A_5; \qquad R_7 = K \cdot A_7$$

Since the area of resistance of the front teeth is the smallest $(A_2 < A_5 < A_7)$, their resistance force is the smallest too $(R_2 < R_5 < R_7)$.

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Editorial

Dentistry in the Upper Brackets of Income

THE Associated Press now announces in display type that the dentists of Great Britain have suddenly been catapulted into the high income brackets, and that now ways and means must be quickly found to cut off the new "dental gold rush." This is significant in that it reveals something badly out of balance in the British "free" health care system, right at the outset. Few dentists have ever reached the high income brackets in Britain or anywhere else, so that fact makes it more interesting. The British pattern is, however, running true to the usual routine—free quantity service, a rush by the public to catch up on the tremendous backlog of neglected teeth over a period of a lifetime. The regarded demand "for free" is tremendous, particularly for eyeglasses and dental fixtures, and it is the first phase of the dental boom. Like all booms, however, it is temporary and levels off as soon as the urge of something, regarded for "free," loses its zest.

As the appalling cost of such service attracts the spotlight (depletion of financial budget occurs) along with publicity, the administrative agencies must do something about it. The next phase then is obvious: cut down the service to fit the budget, or cut the budget to fit the service.

New Zealand is now in this position. She must increase taxes or reduce the services, and it looks like she is sharply reducing the services. Anyway, in all these plans there has been a constant migration into several phases: the initial or speeded-up health service activities, and resultant headaches. The purveyor of dental services is forced to administer wholesale quantities of what the profession regards as of questionable value in order to make a living. The patient, as the recipient of these deflated values and services, is the ultimate loser, and knows little or nothing about the type of service he is getting.

It will be interesting to watch our British confreres to see if the future reveals that they, too, are following past routines. Apparently they are entering phase two and phase one was the first boom dentistry ever had in Britain; obviously it took in too much territory and swamped the budget.

To supply orthodontics, for instance, for the masses of people will no doubt prove to be an interesting question in economics. Orthodontists, even now, under present conditions, have never solved the orthodontic training problem satisfactorily. Given the best training available in America, orthodontists are not regarded as finished at their job until they have served quite a term of either practice or internship. The time element involved in treatment makes it unique in its training problem. It requires time and a lot of it.

About the beginning of the century, Edward H. Angle tried to solve the orthodontic training problem of that day by incorporating a comprehensive course of orthodontic training in the undergraduate curriculum of a dental school. He admitted failure and started a private school that gave orthodontics its start. Even now, fifty years later, no one has ever solved the orthodontic training problem for the undergraduate.

When the money runs out doctors compromise health care in order to make the budget fit the service, or vice versa. They have no choice. Probably where they slipped in their over-all plan in Britain was a failure on the part of the planners to realize that in the case of dentistry, at least, some of it is like a mink coat or an expensive automobile—it is a matter of quality. Other departments of dentistry of the nonappliance kind are regarded as health service like preventive dentistry for children or the treatment of pathology of the oral cavity.

How can sufficient numbers of orthodontists be trained even to scratch the surface of service for the masses unless such training is incorporated into the undergraduate curriculum? No one ever has been able to do that up to now because the time in the undergraduate course is not available for anything other than "gesture" orthodontic training.

The British experiment reveals that their plan in dentistry, at least, is not working satisfactorily for the public and no doubt, even though lucrative, not satisfactorily for the dental profession.

H. C. P.

Reports

REPORT OF THE PUBLIC RELATIONS COMMITTEE

It is the opinion of your Public Relations Committee that there exists in our profession today a definite need for sincere, conscientious introspection. We believe it falls in the jurisdiction of this committee to make such an introspection. We well realize that in so doing we probably will tread on the toes of some individuals and some groups within our profession. We would like to make it definitely clear, however, that this is an unbiased report and submitted only with the best interests of the entire orthodontic profession in mind. We hope you will accept it as such.

Your committee has been encouraged to make such a written report since the verbal report we gave in Charlotte, North Carolina, in 1946. At that time it was mentioned there was an urgent need for improvement in our relationship with the lay public, the general practitioner, the medical profession, and between ourselves. It is around these four points that we build this report.

It is our belief that there exists a great need for improved relations between orthodontists and the general public, especially the parents of the children upon whom we work, and the children themselves. Do you think we should be satisfied with the general attitude of this group toward orthodontics? Hardly a day passes that we do not hear severe criticism of our profession from this group. Because this condition does exist we have asked many people to express their opinion as to the cause. The answers we get from them when we question their dissatisfaction are such as:

1. The appliances caused a lot of cavities.
2. Fee for treatment is too high.
3. Treatment time was estimated at eighteen months to two years and was then not complete for four or five years.
4. Too frequently the case relapsed a few months after the appliances were removed, and this is most disheartening after years of treatment and quite a bit of expense.
5. It was promised in the beginning of treatment that Johnny's mouth would be perfect when treatment was completed, and yet when he was dismissed there were several teeth that were not in perfect alignment. It is true he was much improved and we are not completely dissatisfied, but we should not have been promised perfection when it was not certain that it could be obtained.

Have you ever heard these criticisms? I feel very safe in assuming each of you has heard these and many more. Perhaps sometimes, unfortunately, some of these accusations are true. All too frequently we coast along with the attitude "it can't be true in my practice" but are we sure! Your committee urges you to closer study of your own practice, to check the criticisms we all receive, and to determine sincerely if some of them are justified. If so, in the interest of your practice profession, do all in your power to eliminate them. This is one of the best ways we know to improve public relations.

In interviews with the public we have found the quality they admire most in a professional man is absolute sincerity. Your patients do not expect you to be infallible. They do not expect you to know all there is to know about orthodontics. They come to you realizing your work has definite limitations, so do not promise them results that are uncertain.

Read at the Twenty-fourth Annual Meeting of the Southern Society of Orthodontists, Memphis, Tenn., Oct. 12, 1948.

We urge absolute frankness and sincerity with each and every one of your patients. Do this, and you will find their attitude toward you personally and the profession you represent will be greatly improved.

It is the opinion of your committee that the more privileges one enjoys in a community the greater becomes his responsibility to the community. There are very few individuals who enjoy more privileges in a community than an orthodontist. Consequently, the orthodontist should not only accept, but should *look* for responsibilities in his community. There are many, many ways an able, ambitious person can contribute greatly to his community. It is our theory that the public never begrudges a man personal success if he is appreciative and considerate of those to whom he owes his success. If you enjoy personal success, and hope to enjoy additional personal success, you must lend your abilities to the community giving you that success. You should take the initiative and leadership in boards and committees dealing with health problems in your community. You should provide leadership in projects to aid underprivileged and handicapped children. You should check on the dental programs in your community schools, and if they are not efficient you should provide the impetus necessary for improvement. These are but a few examples; if you will but take the initiative to search in your community, you will find these and many, many more greatly needing assistance which you are capable of giving.

One vitally important factor in public relations is the personal opinion your community has of you as a man, husband, and father. Working with children as you do, you are constantly "on the spot." Your every action is observed by someone in your community—your appearance, your mannerisms, even the very way you walk down the street. Therefore, it is quite essential for you to live your public life in a manner that brings credit to your profession and encouragement to the children and parents with whom you work.

Another point your committee would like to submit for your consideration is that of getting into our profession young men who are basically sound, progressive, and sincere. We feel it is the duty of all of us to solicit into our ranks men of this caliber and not to sit idly by and let the increasing public demand for orthodontics bring into our profession inadequately trained men who think orthodontics is an easy way to get rich quick, and thus place us all in the category of racketeers. If you have in your practice, or your acquaintance, a young man with good background who has all the qualities you know to be so necessary for a good orthodontist, we urge you to encourage him in dentistry and particularly in our field of endeavor. We are the ones who shall be responsible for the next generation of orthodontists; therefore, it is the responsibility of each of us to make certain that our successors are better than ourselves. This can be done only by encouraging in our profession the right kind of men.

The second group with whom more ideal relations must be promoted is the dentists in general practice. We must never become so smug within our own specialty that we forget that the man in general practice is the backbone of dentistry and that he makes the profession of orthodontics possible, not merely by referring to us the patients who are in need of treatment, but also by his approval and acceptance of orthodontics as a worth-while specialty. Too frequently I have heard orthodontists claim they are self-made, that the majority of their patients come from personal friends and other satisfied patients, and they are not dependent on the dentists of the community for the maintenance of their practice. This attitude is quite alarming and definitely must be eliminated entirely if we are to maintain the proper relationship with general dentistry.

There is a vast amount of confusing literature reaching the general practitioner of dentistry from orthodontic origin. One article states that a capable orthodontist never needs to extract a tooth for the successful completion of a case. The next article states that extraction of at least four teeth is necessary in 90 per cent of all cases treated. One article will state that it is never necessary to band teeth other than the six-year molars, and the next article will state that it is necessary to band every tooth in the mouth in order to obtain sufficient anchorage for satisfactory treatment. One article will state that all cases should be treated at 7 or 8 years of age, and the next will state that no case should be treated

until 13 or 14 years of age. Is there any wonder that there is confusion in the minds of the general practitioner of dentistry in regard to orthodontics? Do not misinterpret my remarks as meaning we expect one positive answer for all questions expressing the opinion of all orthodontists. We all know this to be a practical as well as a scientific impossibility. However, your committee recommends some attempt on a national scale to control such confusion. It appears to us that a very simple solution would be for each of us to make the general practitioner realize that each and every case is an individual problem and in some cases extraction is necessary while in others it is not, that in some cases multiple banding is necessary while in others it is not, that in some cases early treatment is indicated while in others it is not. Stress the danger of the general practitioner attempting definite diagnosis, and stress the importance of each and every case which deviates from normal being referred to an orthodontist for positive diagnosis. Keep in the minds of the general practitioner such a confidence in your sincerity that he will not hesitate to so cooperate with you.

We have an obligation to the dental profession in making them realize that orthodontics is definitely a health service. We are often accused by the general practitioner of having no regard for the supporting structures. This is, of course, quite ridiculous, because we know the very basis of our work in correcting malocclusion is to preserve supporting structures which would have been permanently damaged had the malocclusion remained untreated. Yet, apparently we are failing in our education of the general practitioner when we allow him to think otherwise. We are accused by the general practitioner of allowing our appliances to cause cavities. We all know in many cases this is quite untrue, but perhaps in some cases it is true. We use it here merely as a method of bringing to your attention the fact that there is need for closer unified working between the orthodontist and the general practitioner in each individual case. If each of us is careful enough to refer our patients routinely back to the general practitioner for prophylaxis and examination, the responsibility then rests on him. When we fail to do so, we are assuming a responsibility that should not rightly be ours. Your committee therefore recommends that each of us in the future keep the general practitioner in closer contact with his patient. We say with *his* patient because basically it is his patient and he is merely lending the patient to us for a period of time so we can render the patient a valuable service. It is our duty to keep him informed of that service as to the progress, and return the patient to him at the completion of service in such a way that he will commend us and the field of orthodontics and not criticize us and our profession. Too frequently a general practitioner refers a patient to an orthodontist, receives no acknowledgment for his reference, and is never advised of the orthodontist's diagnosis and plan of treatment. He does not receive the patient back for routine check-up, and is never advised when the case is completed. He is not given a review of the case, from the terribly deformed mouth that you took over to the proper-functioning, nice-appearing mouth that you obtained. Is it any wonder then in many cases that dentists' relationship to orthodontics is unpleasant? We maintain that in many cases it is due to lack of cooperation and educational work on our part. Your committee therefore recommends that each of us in the future recognize the reference of every case either by call or letter, that we advise the referring dentist of our diagnosis and plan of treatment in every case, that we have a record system which will enable us to be certain each patient is sent back to the referring dentist at intervals specified by that dentist, and that we keep him informed of our progress as well as our difficulties encountered as treatment progresses. Perhaps most important of all is to be certain that the patient is officially returned to the referring dentist at the completion of the treatment. We recommend this procedure as the very best possible way of improving relationship between general dentistry and orthodontics, and of educating the general dentist to our problems as well as our efficiency. Perhaps some of you are wondering about the patient who is not referred to you directly by a dentist. We recommend that in these cases even more care should be taken to follow the previously mentioned procedures with the patient's dentist, for these are the dentists that you need most to educate.

The third group with which we urge improved relations is the medical profession. In a survey your committee conducted among a representative group of the medical profession, we found them generally to have a favorable opinion of our profession. We found that the pediatrician and the otolaryngologist were much more familiar with our work than were men in the other branches of medicine. This, of course, is naturally due to the fact that one group works entirely with children, and the other with problems concerning the nose and throat. We did find, however, in many cases even the physicians who were most familiar with orthodontics recognized it only for its efficiency in producing esthetic change; and even this they thought was confined to alignment of, as they put it, "crooked teeth." Very few of them recognized orthodontics as a valuable health service. They had never stopped to think of how the producing of a balanced functioning occlusion for a patient who previously had a very low masticating efficiency would greatly improve proper mastication of food, aid greatly digestive and assimilation problems, and thus insure improvement of any health problem correlated with digestion or assimilation. Very few of the physicians consulted realized the orthodontist could quite frequently see manifest symptoms of glandular involvement, and thus be in a unique position either to discover some of these cases which might have escaped diagnosis by the physician, or to help them confirm their diagnosis in cases they suspect. Not too many of the physicians realized the tremendous psychological improvement in patients corrected from an extreme facial deformity to a nice-appearing, well-balanced mouth and face. They did not appreciate the fact that in these cases the psychological change was a great aid to them with patients they were treating in the field of psychosomatic medicine. Many physicians were amazed when they were shown the gross facial bone structure changes we could produce. This was especially true in cases in which the mandible was positioned forward. We found the nose and throat men quite interested in the fact that in many cases we could relieve impaired hearing and referred pain in the sinus areas by forward positioning of the mandible.

We found the obstetrician quite interested in the many cross-bite cases and temporomandibular articulation problems and our theory that it was possible inaccurate forcep deliveries could have been responsible. As a result of this medical survey, your committee recommends that each of you take it upon yourself to educate the physicians of your town to the fact that orthodontics has a direct correlation as a health service with practically every field of medicine, and your problems are much deeper than merely straightening a few crooked teeth, or breaking a thumb-sucking habit. By these educational procedures you will greatly improve the relationship of orthodontics and the medical profession.

The fourth group with which relations must be improved is our own profession. There must be an elimination of antagonism between one section of the country and another. There must be an elimination of antagonism between the men who follow a certain technique and the men who follow another. There must be an elimination of antagonism between men practicing in the same community. Is it not obviously wrong for one orthodontist to criticize another, to claim the technique he follows is the only successful way to treat cases? Certainly each man is entitled to his own opinion and should follow the technique he finds most capable in his hands. One should not attempt to build himself in the minds of the dentists or the public by criticizing and tearing down another's procedures. Abraham Lincoln once said: "Let not him who is homeless pull down the house of another, but let him work diligently and build one for himself and thus be assured that his own shall be safe from violence when built." It is the opinion of your committee that all techniques have their value as well as their bad features. We have not as yet found any one technique which will render perfection in all cases. Should we not then be willing to admit our failures and shortcomings as well as boast of our successes and advantages? It is only thus that true scientific progress can be made.

One of the great problems which confronts the relationship of orthodontists today is involved in the transfer cases. How frequently have you had a patient come to your office as a transfer patient with no advance notice and greet you as you enter the operating room with

the remark, "Dr. X. wanted me to tell you exactly what he wanted done," or "I am practically through with my treatment only a couple of simple adjustments are necessary," yet when you look in the mouth you find a problem that would take at least a year of concentrated effort to remedy satisfactorily? Then there is the patient who comes to your office with the attitude which has been instilled in him by his previous orthodontist that since you live in this section of the country you are quite behind in the latest procedures and he certainly regrets he had to transfer, but under the circumstances hopes something satisfactory might be worked out. I am sure all of you have had these experiences in your offices. Certainly in a group such as the Southern Society and the American Association of Orthodontists, an acceptable standard of transferring a case can be arranged. Surely, if a concentrated effort is exerted, the vast majority of orthodontists can be made to realize that the pleasant and efficient transfer of a case is vitally necessary for their own good, for the patient's good, and for the good of the maintenance and improvement of the attitude of the public toward orthodontics. It is the recommendation of your committee that some attempt be made on a national scale to adjust this unfortunate situation.

Although this report might seem a bit long, actually it is but a brief outline of the many problems confronting the orthodontic profession. It is well realized that the job cannot be handled as simply as has here been outlined. It is going to take much more than outward effort. In some of us it is going to require a change from within as well. By this we mean a return to some of the principles which make us worthy of the title of doctor—yes, even worthy of life itself. Never let the fact escape from your mind that all your worldly goods, success, and abilities are but loaned to you by God, and you are his almoner to dispense them charitably to all deserving people.

FRANK P. BOWYER, D.D.S., Chairman, Knoxville, Tenn.

In Memoriam

HENRY U. BARBER, JR., D.D.S.
1893-1948

DR. HENRY U. BARBER, JR., one of the most energetic and devoted members of the specialty of Orthodontics, died on August 16, 1948, at the age of fifty-four.

Henry U. Barber, Jr., was born in Bolton, Warren County, New York, on October 16, 1893. His early education was obtained in the Bolton District School and in the Glens Falls High School where he was an outstanding member of the baseball, basketball and track teams.

Henry U. Barber Jr.

He attended the Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, from which he was graduated in 1916. He then took a course of instruction in the Jarman Postgraduate School where special attention was given to Crown and Bridgework and Conductive Anesthesia.

In 1917 Dr. Barber was commissioned in the Dental Reserve Corps, United States Army, with the rank of First Lieutenant and received his honorable discharge in 1922.

Written by Dr. Leuman M. Waugh at the request of the Necrology Committee of the Northeastern Society of Orthodontists.

Presented and adopted by the Society in the City of New York, November 23, 1948.

After one year in general practice, he became associated in private practice with Dr. Leuman M. Waugh, Professor of Orthodontics at Columbia University where Dr. Barber became an Instructor.

In 1927 Dr. Barber opened his own office in New York City, limiting his practice to Orthodontics. Because of his integrity and unusual ability, he soon became well established in practice. At Columbia University he was elevated to Assistant Professor in 1937 and was elected to the Faculty in 1939. In 1947 the increasing demands of practice compelled his resignation from Columbia where he had served continuously for over a quarter century. During this time he contributed much to the progress of the Orthodontic Department in the teaching of both the undergraduate and postgraduate students. He also taught in many of the advanced courses for orthodontists which were given under University Extension.

In 1926 Miss Priscilla Sue McLeod, daughter of Edward D. McLeod, D.D.S., of Larchmont, N. Y., was married to Dr. Barber.

During his very active career, Dr. Barber served his profession in many capacities. His dental affiliations embraced the following:

Member of the Darby Dental Society, University of Pennsylvania
Member of the Class Re-Union Committee, beginning in 1916. . . .
American Dental Association
Dental Society of the State of New York
First District (N. Y.) Dental Society
Associate Member Ninth District (N. Y.) Dental Society
Fellow of the New York Academy of Dentistry
Fellow of the American College of Dentists
Diplomate of the American Board of Orthodontics
American Association of Orthodontists—President in 1940-41
Northeastern Society of Orthodontists—President in 1936-37
Member of the Advisory Committee on Orthodontic Care to the Department of Health, State of New York and to the New York City Department of Health
Member of the Advisory Committee, New York State Department of Education on Institutes of Applied Arts and Sciences

Throughout his dental career, Dr. Barber continuously held important committee assignments. He contributed generously to the literature of Orthodontics by papers, clinics and case reports. He also was a master technician.

Dr. Barber's fraternity affiliations included:

Xi Psi Phi (undergraduate dental)
Omicron Kappa Upsilon (honorary dental)
Free & Accepted Masons: Raised in Warrensburg Lodge No. 425 in January, 1919; demitted to Washington Lodge No. 21, N. Y. C., in April, 1926; Senior Warden, 1940; elected Master in December, 1941; appointed District Deputy Grand Master of First District of Manhattan in 1943-44; all of these offices he filled with distinction.

His club affiliations were:

Campfire Club of America—Member of Board of Governors, 1943. . . .
St. Regis Hunting and Fishing Club—President, 1946.

Much of his extra-professional time during the past five years was devoted to the chairmanship of one of the largest and most important committees in the Campfire Club. In the St. Regis Club Harry was regarded as the man who "got" his deer. If a deer were not at hand, a bobcat or a fox would do—temporarily. He was almost always the first one up and the last one in from the day's hunt and at all times was ready to give a helping hand, no matter how trying the task. His cheerful banter about the clubhouse will be greatly missed by members and staff alike.

Dr. Barber was reared on Lake George amidst the stately Adirondack Mountains. His forebears were of the hardy Scottish type that helped make up Rogers' Rangers and "Hank," as his "pals of the trail" affectionately called him, exemplified the "stuff" that would have made him a leader, perhaps one of Rogers' right-hand men, had he lived at that time.

From early boyhood Dr. Barber's greatest delight was to go hunting and fishing with his father and his Uncle, Ellis Barber. Together they would roam the lofty hills each autumn, camping as they went, and never was there a season that they did not bring home the "meat." He was also fond of boats and fishing. Several years ago he had a fine cruiser launched on Lake George from which he fished and found the greatest pleasure in entertaining his friends.

In the wilderness he was at his best, meeting challenges in rugged sportsmanship in his stride. One of the best outdoorsmen of the Campfire Club paid Hank a signal tribute by saying, "If I had to choose a man to accompany me on a difficult journey into the wilderness, I would choose Hank Barber as my companion." We who have hunted with him and shared the tough experiences that often confront men in the hunt for big game can attest to the soundness of this man's judgment. We have lost a pal, one of Nature's noblemen, the like of whom we shall not hope to meet again—at least, not on this side of the Great Divide. Who knows, perhaps Hank will be waiting there with finer streams and greater trails than we had known here.

"One morn I miss'd him on the custom'd hill,
Along the heath, and near his fav'rite tree;
Another came; nor yet beside the rill,
Nor up the lawn, nor at the wood was he."

Throughout his married life, Dr. Barber's constant companion was his wife, Priscilla. To the very end, it was Harry *and* Priscilla *together*. Both died almost instantly in an automobile accident shortly after midnight on Monday morning, August 16, 1948.

Surviving are their two children, Priscilla Jane and Henry U. Barber, III, of Scarsdale, N. Y.; Harry's mother, Mrs. Clara A. Barber, of Bolton, N. Y.; Priscilla's mother, Mrs. Letitia McLeod of Scarsdale, N. Y.; and Harry's two

sisters, Mrs. George Nelson of Schenectady, N. Y., and Mrs. George E. Beaton of Glens Falls, N. Y.

To his profession, to his professional colleagues personally and to his many grateful patients, the passing of Henry U. Barber, Jr., will be felt as a distinct loss. To their close friends, to those who knew them best, Harry and Priscilla will endure in loving memory until the last one is called Home.

RESOLUTION: The members of the Northeastern Society of Orthodontists have learned with profound sorrow of the sudden death of their beloved fellow member, Dr. Henry U. Barber, Jr., and his wife, Priscilla, on August 16, 1948.

We desire to express our deepest appreciation of Dr. Barber's worth to his profession and to his specialty and of his accomplishments which aided and improved our Society throughout the many years of his service.

His qualifications were unusual, comprising the highest integrity and devotion to his profession and to his patients. His advice was uniformly wise and sound and was always given with kindliness and courtesy.

His ability, always at the service of others, his untiring energy and his unswerving sense of honor left a standard worthy of emulation by all who came in contact with him.

Their loss is keenly felt by this Society and each of us knows a deep sense of personal grief that the pleasant association of so many years with friends of such intelligence, judgment and personality is ended.

To his family we extend our deepest sympathy with the hope that the knowledge of the esteem in which he was held may prove of lasting comfort to them.

BE IT RESOLVED, That this resolution be spread upon the minutes and that a copy be sent to Dr. Barber's family.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Dentition of Indian Crania From Texas: By Marcus S. Goldstein. *Am. J. Phys. Anthropol.*, new series, **6**: 63-84, March, 1948.

The present study is based on observations on the dentitions of Indian crania from Texas. These crania were for the most part excavated by the archeologists of the University of Texas from pre- and protohistoric sites in various parts of the state.

Two kinds of dental observations are considered: first, those phenomena which are entirely or largely the consequence of the environment, namely, wear of teeth, dental caries, alveolar abscess, antemortem loss of teeth; and, second, those characters which are genetically determined, namely, shovel-shape of the incisors, supernumerary teeth, congenitally missing teeth, number of molar cusps, and molar cusp pattern. The variability in occurrence of genetically determined characters in different groups of man, especially dental characters which, except for attrition or decay, are presumably unaffected by the environment, should be of pertinent anthropologic and biologic interest.

Probably the genetic make-up of the individual is involved even in a condition like caries, some people having a greater inherent resistance to the disease than others, yet there is much evidence that the types of foods eaten, even the kind of water imbibed, have a very considerable, perhaps decisive, effect on the prevalence of dental caries. With the State of Texas so vast in area and varied in its natural environment, it should be of special interest to note the effects of the differences in regional environment on the dentition of the early Indian groups living in these regions, whose cultures and food patterns undoubtedly were conditioned by the diversity in natural environment. Hence, the material is divided on a regional basis which also conforms roughly with the known archeological horizons of the area.

Notes taken in the course of the dental observations repeatedly commented on the lack of extensive development of secondary dentine in the teeth affected by attrition, i.e., in many cases of extreme wear of the molars, the pulp cavity seemed to have been exposed relatively early, a considerable amount of tooth still remaining, in contrast, for example, with conditions noted in Eskimo crania in which the teeth are commonly worn to the "gum" before the pulp cavity is exposed. Interestingly, the teeth of the Mission Indians in South Texas were very little worn, in sharp contrast to the excessive wear of the teeth in all of the other crania which represented groups having had no contact with European foodstuffs.

The prevalence of dental caries, antemortem loss of teeth, and alveolar abscess, respectively, in crania of adult individuals of the early Indian groups in Texas was studied. Only cavities which seemed the result of decay, so far as the writer could judge, were considered as caries.

Loss of teeth, of course, may be as much, or more, the consequence of excessive attrition and concomitant alveolar abscess as that of caries, and pronounced wear of the teeth did, in fact, occur relatively most frequently among the West Texas Indians. Indeed, it may be remarked that a number of the West Texas crania, representing people of about middle age according to suture closure, had all of the lower molars missing, with the supporting structure completely resorbed, the upper molars in the same skulls, however, still being in place.

All of the Texas Indian crania with permanent incisors in which the character could be ascertained manifested some degree of the lingual rim and fossa or shovel-shape in the upper front teeth. Hrdlička appears to have been the first to point out that the shovel form of the upper incisors was a feature peculiar to Mongoloid peoples.

The incidence of adult crania with one or more of the third molars congenitally missing is indicated. Only those crania were counted which had at least the molar regions of the upper and lower jaws preserved. One or more third molars is missing in 18.1 per cent of the males and 21.5 per cent of the females. The lower third molar is missing more frequently than the upper third molar, an observation noted in other groups also (Pedersen, 1939). Hellman (1928) found 13 per cent of the mandibles of American Indians with congenitally missing third molars, a figure much like the 14.3 per cent of the mandibles with missing third molars among the Texas Indian groups. American whites, according to Hellman (1936), show congenitally missing third molars in 21.7 per cent of males and 30.8 per cent of females, somewhat higher figures than noted among the early Indian groups living in Texas. Indeed, it is of interest to note that even among early Indian groups there was a wide range of variation in frequency of individuals with congenitally missing third molars, since only 8.5 per cent of the males and 3.7 per cent of the females at Pecos pueblo, according to Hooton (1930, p. 119), showed suppression of the third molar.

The incisor was the only tooth other than the third molar congenitally missing in the present series of Indian crania. It may be noted that congenitally missing lateral incisors, according to Hrdlička (1921), occurred in some 3 per cent of white Americans, a relatively much higher incidence than the 0.6 per cent in the Texas Indian crania.

Leigh (1925) illustrates a case of suppression of mandibular lateral incisors in a series of 400 American Indian crania, a relatively much lower incidence than the 1.7 per cent found in the present Texas crania. Pedersen (1939) lists at least 2 of 1,118 Greenland Eskimo crania as showing congenitally missing lower lateral incisors in the permanent dentition, also illustrating a case of a missing lower lateral incisor in a modern Dane. Ohashi and Tonihara reported to Pedersen that as many as 3.6 per cent of the lower lateral incisors were congenitally missing in recent Japanese in Formosa; and the work of Dolder is cited as reporting 1.1 per cent of 10,000 children from Switzerland with congenitally missing lower lateral incisors (Pedersen, 1939).

So far as the writer knows, there is no information as to whether suppression of the lower lateral incisor is genetic in origin. Such accidents might indeed occur, but the fact that the incidence of missing lower lateral incisors is no less than that of the upper lateral incisors in some groups (Montagu, 1940), and since the heritability of the latter has been repeatedly demonstrated, it would seem the probability of a genetic explanation for suppression of the lower lateral incisors cannot be excluded.

As regards impaction of teeth, both genetic and environmental factors may be involved. A jaw too small to accommodate the dentition could be the result

of an inherent or genetic cause, or of a disturbance in growth due to sundry environmental reasons. In any event, not many of the Indians in the Texas region apparently had impacted teeth, although when it did occur, the impaction was often extreme, e.g., canines and incisors high in the maxilla or deep in the mandible. Some 6.0 per cent of the females, as compared with 3.3 per cent of the males, had impacted teeth.

The relative frequency of crania with supernumerary teeth, 2.2 per cent among the Texas Indian groups, is quite similar to that noted in the Pecos pueblos, 1.6 per cent (Hooton, 1930); supernumerary teeth were observed in 0.9 per cent of "white North Americans" according to Stafne.

It is clear that the Indian groups in Texas were much like the Pecos pueblos in number of cusps in the upper molar teeth, the primary formulas in each being 4-4-3, 4-3-3, and 4-4-4, the first and second formulas each occurring in some 30 per cent and the last in about 20 per cent of the crania in both groups.

Data on the deciduous molars indicate that 2 cusps generally occur in the upper first molar and 4 cusps nearly always in the second. The deciduous second molars, lower as well as upper, appear to be virtually identical to the permanent first molar in number of cusps and, in the lower teeth, in cusp pattern. The explanation for this striking similarity is not clear.

Number of cusps and the cusp pattern in the lower molar teeth of the Texas Indian groups are compared with corresponding original data on Alaska Eskimos. The method of determining cusp pattern is simple and has been fully explained and illustrated in the works of Gregory and Hellman (1926) and Hellman (1928). In brief, the buccal cusps, from front to back, are designated as 1 and 3, and the lingual cusps, also front to back, as 2 and 4, each being more or less separated, of course, by the transverse and longitudinal grooves. When cusps 1 and 4 are in contact in the center, often preventing cusps 3 and 2 from meeting, it is called the cruciform or plus-shaped pattern; when there is contact in the center between cusps 3 and 2 and none between 1 and 4, it is considered the Y or *Dryopithecus* pattern.

According to Gregory and Hellman in the studies cited, the Y pattern, especially when associated with 5 cusps, is the typical "*Dryopithecus* pattern" of the lower molars, while the cruciform (+) pattern, particularly when concurrent with a reduction in number of cusps, is a progressive stage in lower molar crown evolution.

The present data indicate that in the permanent dentition it is only the first molar which is predominantly of the *Dryopithecus* Y pattern, generally with 5 cusps; this is evident in both ethnic groups, although much more accentuated in the Eskimo. The second and third molars, especially the former, are most commonly cruciform in pattern, both in the Texas Indian groups and in the Eskimo.

Differences in molar cusp numbers and patterns among various groups of Indians, as well as among peoples of other races, are probably due to inadequate samples, or when the samples are adequate, to actual variability in subgroups as a result of secular factors such as greater isolation and inbreeding in one group than another.

Cusp number and pattern of the lower deciduous second molar are strikingly like the permanent first molar, with a high prevalence of the Y pattern and 5 cusps, in fact, not one of the present series of deciduous teeth showing less than 5 cusps.

Mention perhaps should be made that not infrequently in the present series 6 cusps actually referred to 4 ordinary and 2 definitely smaller or "half" cusps, the hypoconulid usually being divided into 2 smaller cusps; similarly, 7 cusps could refer to 5 ordinary and 2 smaller cusps. This distinction in size

of cusps occurs in the upper molars as well as in the lower, although never in the upper first molar, at least not in the present series.

There are heritable traits occurring in varying frequencies in local groups of the same race. Congenital absence of the third molars is a case in point, occurring in all groups of man, and yet varying considerably as between local groups. Probably the degenerate or missing incisor teeth, and even the occurrence of supernumerary teeth, could be considered in this category. These latter phenomena in fact occur so relatively infrequently in any group (highest incidence of individuals with missing upper lateral incisors, 3.2 per cent in whites; highest incidence with degenerate or missing upper lateral incisors, 7.8 per cent in Chinese—adapted from Hrdlička by Montagu, 1940), that the genetics involved would seem necessarily confined to particular family lines. The incidence of missing incisors therefore could be greater among families of the same group than between 2 or more different groups.

Environmental factors such as geographical or social isolation and consequent inbreeding, social customs conducive to outbreeding, and the like, must bear most directly and profoundly on the genetics of the local group. This process would seem to be applicable today in "civilized" societies in which the local group has generally become enlarged, as well as, and probably in much greater force, to "primitive" societies, past and present. It is recognized, of course, that the genetics of the local group is part of that of the larger population or race. All that is being suggested is that there are genetic traits more peculiar to local groups than to the larger population as a whole, and that the relative frequency and even kind of genetic traits are in each instance most influenced by specific environmental factors indigenous to the local group.

Caries was most prevalent in the agricultural East Texas Indians and least prevalent in the nomadic food gatherers and hunters of Central and North Texas. The West Texas cave dwellers suffered most from alveolar abscess and antemortem loss of teeth, probably more as a result of marked attrition of the dentition than of caries. Regarding age, caries and antemortem loss of teeth seemed relatively rare in childhood among these Indians. In fact, antemortem loss of teeth and alveolar abscess both appeared a concomitant of increasing age after about 35 years.

The shovel-shaped incisor occurred in all of 124 crania with the permanent dentition, 95 per cent of these manifesting a well-defined degree of shovel-shape; the feature was found to be much less common in the deciduous dentition. Congenitally missing third molars occurred in 19.5 per cent of the crania, relatively more in the lower than in the upper jaw. Only 4.5 per cent of the crania had impacted teeth; 3.4 per cent had congenitally missing incisors; 2.2 per cent had supernumerary teeth. The primary M1-M2-M3 cusp formulas in the upper jaw were 4-4-3 (30 per cent), 4-3-3 (30 per cent), and 4-4-4 (20 per cent). Data on deciduous upper molars showed 2 cusps generally in M1 and 4 cusps nearly always in M2. Data on number and pattern of cusps in the lower molars are given for Eskimo as well as the Texas Indians. In the permanent dentition only the M1 is predominantly of the *Dryopithecus* Y pattern, generally with 5 cusps; the M2 and M3, especially the former, are each most commonly cruciform in pattern; 5 cusps (or more) occur much more frequently in the M2 and M3 of the Eskimo than in those of the Texas Indians.

A discussion of the results attempts to evaluate the meaning of different types of relative frequencies of morphologic hereditary features; it is noted that some are common to the species, others seem to have racial significance, and still others reflect conditions in local tribes or groups. It has been suggested that the environment is a pervasive influence in diverse ways whatever the genetic character, but also that the environment is probably a most direct and potent factor in the genetics of the local group.

News and Notes

American Association of Orthodontists
The 1949 Annual Meeting, May 2, 3, 4, 5, and 6, 1949
Commodore Hotel, New York, N. Y.

PROGRAM OF ENTERTAINMENT

New York is waiting to entertain you. The committee has arranged a well-rounded program. Whether you are an outdoors man or would rather devote your leisure time to indoor sports makes no difference. The program committee has provided sports for the entertainment of all. In addition to the extensive ladies' program which has already been announced, the men will also find interesting entertainment, whether as active participants or as spectators.

The Campfire Club, situated right outside of New York City, will be at the disposal of the men on Monday, May 2, for the afternoon and evening. Busses will be provided to take you to the Club and back to the hotel. Demonstrations will be held of outdoor sports such as skeet shooting, marksmanship, fly casting, bloodhound trailing, fire building, and other outdoor skills, and these will be performed by experts. In the evening there will be a dinner and entertainment you will long remember.

A sightseeing boat trip around Manhattan Island for the men and ladies has been scheduled for Monday morning, May 2. The famous New York skyline and other points of interest have long attracted visitors from all over the world. You will long cherish the memory of this interesting trip. Men who wish to spend the afternoon and evening at the Campfire Club may leave the boat and board special busses that will take them to the Club.

The ladies are cordially invited to a "get acquainted" tea as guests of the Northeastern Society of Orthodontists, while the men are at the Campfire Club.

The ladies' luncheon on Tuesday, May 3, is an event on which much time and effort have been spent. Every lady is assured of an interesting and enjoyable time.

An International Luncheon will be held on Tuesday, May 3, 1949. The American Association of Orthodontists has extended invitations to representatives of orthodontic organizations throughout the world. Your attendance on this occasion will introduce you to our colleagues in the practice of orthodontics in other countries. All members and guests are urged to attend.

Broadway shows have put aside special reservations for those attending this convention. If you are interested in going to a show Tuesday evening, the entertainment committee will help you obtain seats.

The President's Reception and Ball of the American Association of Orthodontists will be held on Wednesday evening, May 4. The committee requests you to reserve May 4, 1949, on your engagement book. A program of outstanding entertainment and a leading orchestra have been engaged for this occasion.

A trip to United Nations and other interesting tours have been scheduled. And, just in case you want to go off on your own and visit around New York, Thursday evening has been set aside for this purpose.

You are advised to make hotel reservations now to assure desired accommodations. If you write to the Commodore, mention that you are attending the convention of the American Association of Orthodontists. Why not spend two week ends in New York while attending the meeting, May 2 to 6, 1949? You are expected and will be made welcome.

ENTERTAINMENT FOR THE LADIES

The committee urges that all questionnaires be filled out and returned as soon as they are received. The members of the ladies' committee are ready with a hearty welcome and an extraordinary program. Mrs. Lowrie Porter, Chairman, and the entire ladies' committee urge you to bring the ladies in your family to enjoy New York, meet old friends, and make many more new ones.

Tea—luncheon—theaters—broadcasts—tour of the United Nations—and plenty of time for shopping!!!

DR. NORMAN L. HILLYER, Chairman,
Ladies' Entertainment Program.

American Board of Orthodontics

The 1949 meeting of the American Board of Orthodontics will be held at the Commodore Hotel, New York, N. Y., April 28, 29, 30, and May 1. Orthodontists who may desire to be certified by the Board may obtain application blanks from the Secretary, Dr. Stephen C. Hopkins, 1726 Eye Street, N.W., Washington 6, D. C.

Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists; any person affiliated with a recognized institution in the field of dentistry as a teacher, researcher, undergraduate or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art or science of orthodontics.

Prize.—A cash prize of $500 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if in its judgment none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be typewritten on 8½ by 11 inch white paper, double spaced with 1 inch margins, and composed in good English. Three copies of each paper, complete with illustrations, bibliography, tables, charts, etc., must be submitted. The name and address of the author must not appear in the essay. For purposes of identification, the author's name together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a separate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held in New York City, New York, May 2-6, 1949.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate by the Chairman of the Research Committee on or before March 15, 1949.

ALLAN G. BRODIE, Chairman Research Committee,
American Association of Orthodontists,
30 North Michigan Avenue, Chicago 2, Ill.

Pacific Coast Society of Orthodontists

The regular biennial meeting of the Pacific Coast Society of Orthodontists will be held Feb. 21, 22, and 23, 1949, at the Palace Hotel, San Francisco, California.

Central Section, Pacific Coast Society of Orthodontists

The next meeting of the Central Section of the Pacific Coast Society of Orthodontists will be held Feb. 21, 22, and 23, 1949, at San Francisco.

Southwestern Society of Orthodontists

The 1949 meeting of the Southwestern Society of Orthodontists will be held at the Texas Hotel, Fort Worth, Texas, March 13, 14, 15, and 16, inclusive, 1949.

The Cincinnati Dental Society

The Cincinnati Dental Society takes pleasure in announcing that its March Clinic Meeting and Children's Dental Health Day will be held at the Netherland Plaza Hotel on March 20, 21, and 22, 1949.

Thomas P. Hinman Midwinter Clinic

The Thomas P. Hinman Midwinter Clinic will be held at the City Auditorium, Atlanta, Georgia, on March 20, 21, 22, and 23, 1949, under the auspices of the Fifth District Dental Society.

Oliver Testimonial

The AMERICAN JOURNAL OF ORTHODONTICS is in receipt of a letter advising that a testimonial party will be given for Dr. Oren A. Oliver of Nashville, Tennessee, on Saturday, March 12, 1949. The Committee in charge is as follows:

Dr. Walter T. McFall,
602 Flatiron Building,
Asheville, North Carolina

Dr. Frank P. Bowyer,
Medical Arts Building,
Knoxville, Tennessee.

Dr. Leigh C. Fairbank,
1726 Eye Street, N. W.,
Washington 6, D. C.

Dr. Boyd W. Tarpley,
2118 14th Avenue, S.,
Birmingham, Alabama.

Dr. E. C. Lunsford,
2742 Biscayne Boulevard,
Miami 37, Florida.

The following letter has been received:

Greetings:

Because no man in dentistry or orthodontics has served longer, more faithfully, more sincerely, and more completely, a large group of friends and admirers have wanted to give a testimonial meeting to honor Dr. Oren A. Oliver, 1915 Broadway, Nashville, Tennessee.

Dr. Oliver has served for forty years with honor, distinction, and outstanding benefit to his profession and specialty as well as the public in every local, district,

state, national, and international group in dentistry and orthodontics. His manifold genius for organization, for thoroughness in motivation, in teaching, in promoting, in inspiring is not equalled by many and rarely excelled.

Our friend attended colleges in Virginia and graduated from Emory University School of Dentistry, Atlanta, Georgia, in 1909. He has not only served dentistry and orthodontics through every phase of organizational work, but has left a record hard to equal in his administrations as president of the American Dental Association and the American Association of Orthodontists. He has been an invaluable and indefatigable worker for dental education, public health; and the social, welfare, civic and cultural side of life has known that this good man's every heartbeat is for making life sweeter, finer, cleaner, and more wholesome.

A group of us are making definite plans for a testimonial seminar in orthodontics, also a luncheon, fellowship party, and banquet dinner in the evening to honor Dr. Oren A. Oliver and to pay him this just and well-deserved tribute. The meeting will be held at the beautifully appointed Mayflower Hotel in Washington, D. C. The meeting will start with a smoker on Friday evening for those present; orthodontic seminar all morning and early afternoon; the luncheon; the fellowship party, and finally the evening banquet. All of these meetings and sessions will be held at the Mayflower Hotel. The management has very graciously reserved two hundred rooms for us. Reservations should be sent at once to Dr. Leigh C. Fairbank, 1726 Eye Street, N. W., Washington 6, D. C. The hotel reservations will be accepted in the order they are received.

A self-addressed postal card is enclosed. Fill out at once and return it so your working committee may complete plans for your presence and enjoyment as we all met to honor Dr. Oliver next March. We sincerely hope and trust that you can be with us in Washington on Saturday, March 12, 1949, to honor this fine nobleman of dentistry and orthodontics who has done so much for all of us.

Please return your postal card *now*. Extensive and elaborate plans have been made so we hope you will be with us to enjoy it all.

Cordially and fraternally yours,
WALTER T. MCFALL (For the Committee).

Encl.

P. S. Committee particularly requests that those sending in returned postal cards indicating their intention of being present should print or type their names and addresses so there may be no confusion in reservations.

The committee in charge of the testimonial to be given for Dr. Oliver desire that some facts be pointed out for the benefit of those who expect to make the trip to Washington:

1. There will be a smoker on Friday night at the Hotel Mayflower in Washington, D. C., for those who arrive Friday evening.

2. The orthodontic seminar will be started at 9:30 A.M. and run until 12 noon Friday. New motion picture of more than 3,000 feet will be shown for the first time, and this will be supplemented with slides.

3. The testimonial luncheon will be held at 12:30—2 P.M. This will be held at the Hotel Mayflower in Washington. All dentists are urged to attend.

Denver Summer Seminar

The Twelfth Denver Summer Seminar for the advanced study of orthodontics will be held July 31 to Aug. 5, inclusive, 1949, at the Park Lane Hotel, Denver, Colorado. Dr. Howard Yost, Grand Island, Nebraska, is the new president of the Denver Summer Seminar, and Dr. E. S. Linderholm, Denver, Colorado, the new secretary. The complete program for the seminar will be announced early in 1949.

Announcement

There is a vacancy for assistant in the Orthodontics Clinic at the Lenox Hill Hospital. The service is on Monday and Wednesday mornings from ten to twelve o'clock. The position does not offer any salary. If interested, address:

The Chief of Orthodontics Clinic,
Lenox Hill Hospital,
111 East 76th Street,
New York 21, New York.

Orthodontist Returns From South American Trip

Dr. Harry Wright, orthodontist of Philadelphia, Pennsylvania, has returned from a South American trip on which he and his friends visited an Indian tribe in Brazil. The tribe was discovered a year ago by an expedition with which Dr. Wright was traveling. Pictures taken by the dentist appeared in *Life*.

Dr. Wright also brought back film of a 14-foot alligator being devoured in two minutes by thousands of piranha fish.

A Program to Meet the Urgent Manpower Requirements of the Army Medical Department

One of the most critical shortages in our entire military establishment is that facing the Army Medical Department.

The gravity of this shortage stems from the fact that only highly trained professional people can fill it. Physicians, dentists, and nurses are especially needed, and there are urgent requirements for members of other professions allied to medicine.

To date the Medical Department is meeting its obligations to provide adequate medical care to men coming into the service. But as the Army and the Air Force expand to their full authorized quotas, the rate of medical personnel coming in must be increased.

If a shortage were allowed to develop, it could become a serious threat to the national defense program. The Selective Service Act of 1948 provides that "no person shall be inducted until adequate provision shall have been made for medical care."

The Army and the Air Force will observe that provision. They have achieved the highest medical, dental, and health standards in the world, and those standards will not be compromised under any circumstances. Instead, the Army and the Air Force will intensify their efforts to obtain volunteers to fill their needs for professional people.

The specific requirements for additional physicians, dentists, nurses, veterinarians, dietitians, occupational therapists, physical therapists, pharmacists, sanitary engineers, allied scientists, and administrators will be announced as the Armed Forces expansion program is implemented.

In recognition of the gravity of this problem, and of the responsibility of the medical profession as one group to help met it, the House of Delegates of the American Medical Association approved the following resolution at its annual convention in June, 1948:

"Resolved: That the State and County Medical Societies be urged by the action of the House of Delegates of the American Medical Association to exert every effort in their communities to ensure that a sufficient number of available physicians be encouraged to volunteer to serve their Nation during this period of emergency."

THE PROGRAM

To meet this urgent problem, the Medical Department has developed a joint program in coordination with several of the national organizations which represent the professions involved.

This joint effort constitutes a nationwide campaign to inform the members of these professions of the urgency of this defense problem and the importance of the contributions they can make. It will involve some of the professional associations, and full use should be made at the local level of the great fraternal, civic, and patriotic organizations in cities and towns throughout the country. These groups, which have actively supported the Volunteer Enlistment Program of the Army and the Air Force for more than two years, represent the leaders of public opinion in practically every American community.

Within the community the program should be organized to take advantage of the facilities of civilian Military Manpower Committees, which already have been set up in more than 600 cities and towns. These committees work with the Army and Air Force Recruiting Service in mobilizing community support for the Volunteer Enlistment Program. They should be urged to cooperate in this program with local chapters of the other national organizations, both professional and nonprofessional.

In addition, the facilities of Army Advisory Committees in communities where they exist should be utilized. The aid and counsel of Army Advisory Committees can be particularly helpful in the large metropolitan centers.

Since the procurement of physicians, dentists, and other professional people cannot be conducted satisfactorily by laymen, this program calls for the organization of a subcommittee to be called the *Professional Manpower Committee* for each local Military Manpower Committee. The Professional Manpower Committee should be jointly headed by an outstanding local physician or surgeon and an outstanding dentist. These two could be the medical and dental professions' representatives on the Manpower Committees. They should work with the Manpower Committee chairman and representatives of the veterinary, nursing, and other allied professional associations to appoint a member from each group to the Professional Manpower Committee. County or state medical and dental societies should be asked to nominate their professional representatives for the joint chairmanship of the Professional Manpower Committee.

Members of the Professional Manpower Committee could be expected to serve as local spokesmen for the Army Medical Department and for their respective professions in contacts with local profession-school students, interns, residents, and those professional people now engaged in practice. Other functions can be suggested for them as the program develops. The Military Manpower Committee itself should support the Professional Manpower Committee's undertakings and make available its publicity and liaison channels throughout the community.

The goal of the community program will be to help meet the needs of the Army Medical Department for professional volunteers, without lowering local standards of health and medical and dental care. The Professional Manpower Committee, in cooperation with each local professional society, might be asked first to survey the community to get an idea of the number and type of professional people who might be considered potential volunteers for military service. Some professional associations have already considered voluntary quotas by states, and these quotas will be announced as they are finalized. For example, such quotas have been developed by the American Nurses' Association in connection with forty state groups.

A program kit and other printed material useful in setting up and operating the local program will be supplied to each Professional Manpower Committee by the Medical Department through the local United States Army and United States Air Force Recruiting Station. In addition, some of the national professional organizations have agreed to channel information keyed to their own professions to their local societies for use in this program.

As the program develops, Medical Department officers in the six Army areas and thirteen general hospitals will be available as guest speakers for special rallies, for regular meetings of cooperating organizations, and as interviewers to talk with local prospects.

Detailed suggestions on ways in which the Professional Manpower Committee can exploit a visit by Medical Department representatives will be provided in the program kit. However, the program cannot be keyed to these visits for they will be brief and should represent only a small part of the effort invested in this campaign in each community.

TWO COURSES OF ACTION

To attract professional men and women to military service in the numbers required, two courses of action should be followed. The first is to tell professional people about the benefits and opportunities open to members of their professions in the Army Medical Department. The second is to let the younger members of these professions understand that their colleagues, their patients, and the other members of their communities expect them to meet their individual responsibilities for the nation's defense. These two courses of action should be pursued simultaneously in a twofold community program.

The first of these efforts is a simple task of spreading information. The opportunities and benefits available to professional people in the Medical Department speak for themselves; they require no high-pressure salesmanship. The Army and the Air Force have provided important new inducements for members of the medical, dental, nursing, and allied professions. Professional people will realize the value of these incentives if this information is brought to their attention.

Physicians, dentists, graduate nurses, and veterinarians enter the Army in the grade of first lieutenant or higher, in recognition of the advanced education they already have completed. Doctors of philosophy or those holding a master or bachelor of science degree in technical fields allied to medicine are given commissions as first lieutenant or higher when they enter the Medical Service Corps. And to raise the incomes of medical and dental officers closer to the levels enjoyed by successful civilian doctors, Congress has authorized a pay increase of $100 a month for all volunteers on active duty in the Medical and Dental Corps.

Measured in terms of cash pay alone, the income of an Army physician or dentist seldom equals that of his civilian colleague. But all Army officers receive tax-free allowances for quarters and subsistence, and they are assured of periodic promotions and longevity increases. Their retirement benefits also represent a significant item of income. An Army colonel can look forward to a lifetime pension of $412.50 a month after thirty years' service. It is estimated that a 25-year-old civilian would have to pay premiums of $1,828 a year for thirty years to finance a retirement policy which would yield the same rate of payment.

Apart from these benefits, the professional officers of the Medical Department have unexcelled opportunities for advanced training in their own fields of specialization. These are available not only at Army general hospitals and medical centers, but also in limited numbers at the nation's leading civilian institutions.

Physicians, dentists, and other professional people who leave their established practices to serve with the Army Medical Department will ultimately benefit their communities as well as themselves. When they complete their military service and return to civilian practice, their increased professional skill will be a continuing benefit to their patients.

Apart from the opportunities the Army offers for advanced professional education and specialization, all professional people in the Medical Department are kept up to date on the latest advances in their fields. Army medical and dental officers have pioneered in several important contributions to their professions, and full information on these developments is circulated throughout the Department. The countless opportunities for professional advancement constitute one of the most significant advantages of service in the Army Medical Department.

These and other benefits and opportunities provide valuable incentives for volunteers. If these inducements are described to the younger physicians, dentists, nurses, and other professional people in allied fields, they will have a foundation of fact on which to judge for themselves the advantages to them of military service.

But even these considerations cannot attract professional men and women in the numbers required unless the people feel a greater incentive to participate in the national defense. The creation of this attitude is the goal of the second course of action in this program.

The local professional societies should take the leadership in this phase of the program. Nonprofessional members of the community can help in several ways. They can indicate their willingness to dispense with medical and other professional services which are not absolutely essential. And they can directly encourage qualified professional people to participate voluntarily in the nation's defense.

Many of you in this audience are dentists. Those of you who were in the services, or who have heard other dentists speak about the Medical Department, probably have heard complaints that dentists in the Medical Department always were under command of a physician or a surgeon. All that has been changed as of Sept. 27, 1948.

A new Army regulation which went into effect on that date provides that dental officers will have administrative control over their own services, personnel, and activities. This regulation equalizes the career opportunities of Dental Corps and Medical Corps officers. Dental officers will serve on the commanding officer's staff and will be responsible directly to the commanding officer for matters pertaining to the dental health of the command.

This regulation is an important step to dentists in the Medical Department. It is another example of the "professionalism" approach of the Medical Department.

The Dental Corps needs both Regular Army officers and Reserve officers. To the Regular Army officer, the Dental Corps offers a career of steady progress, with ample opportunities for research and advanced schooling. The Army's Career Management Program allows a dental officer to progress through his Army career, growing in professional ability. Many research opportunities exist at the research center at Walter Reed Hospital.

All Regular Army dentists in their first 14 years of service take advanced training courses in general dentistry and four months at Brooke Army Medical Center in field training. They also have the opportunity to apply for advanced special training of one year or more in civilian institutions. All of this adds up to a fruitful and interesting career for the dentist who chooses the Army.

The Medical Department's immediate need, however, is for Reserve officers who will enter on a tour of duty for one, two, or three years. By tradition the Regular Establishment is limited in number. Congress imposes ceilings designating the maximum number of specialists, such as dentists, who can be commissioned in the Regular Army. Today's need for a large Army and Air Force has made it necessary for Congress to increase the number of those on full-time duty far beyond the limit set for the Regular Establishment.

Normally, many officers could be solicited from the Reserve. But, today, the Reserve needs bolstering. Also, many of those in the Reserve served anywhere from three to five years in the Army during the war.

There are many opportunities for Reserve officers to go on active duty. Officers are commissioned in the grades of first lieutenant through colonel, depending upon their experience. All dental officers are commissioned at least as first lieutenants in recognition of their advanced schooling. Senior dental students can apply for one of the Medical Department's internships in certain Army hospitals certified by the American Dental Association. Students who are accepted are commissioned as first lieutenants in the Reserve.

For others who come on active duty as Reserves there are opportunities to work in their specialty in Army hospitals. Through associations with other dentists, the exchange of techniques, participation in autopsies, and opportunities for research, they grow professionally. Reserves also may act as teachers in hospitals in the Dental Intern Program. Attendance at and active participation in meetings and associations are encouraged. This may be done without taking leave. The Dental Corps wants as many as possible of its members to pass the Specialty Boards which are established by the American Dental Association.

Wherever the Army dentist is, his equipment and supplies are the finest and most modern. They cost him nothing.

Financially, the dentist has an advantage over most of the other Medical Department officers. Along with physicians, the dentist who volunteers receives an additional $100 a month above base pay and allowances. Congress authorized this increase in order to bring the Army dentist's pay more nearly in line with that of civilian dentists.

Notes of Interest

Dr. Brooks Bell, Dr. Joe Favors, and Dr. J. Frank Roark announce the removal of their offices from the Medical Arts Building, Dallas, Texas, to 4150 Mockingbird Lane at Preston Road, Dallas, Texas, telephone Lakeside 5159, practice limited to orthodontics.

Dwight A. Jackson, D.D.S., M.S., announces the opening of his office at 326 Nissen Building, Winston-Salem, North Carolina, telephone 4-4192, practice limited to orthodontics.

Dr. James T. Walls wishes to announce the association of Dr. Guy A. Woods, Jr., in the exclusive practice of orthodontics at Suite 520 Medical Dental Building, telephone BE 7715, Portland 5, Oregon.

Dr. Lehman M. Waugh and Dr. Donald B. Waugh desire to announce the association of Dr. Robert F. Madden in the practice of orthodontics at 931 Fifth Avenue, New York 21, N. Y., Regent 7-3131.

Death Takes Dr. M. H. Fisher

Dr. Milton H. Fisher, 56, one of Tacoma, Washington's leading orthodontists, died suddenly in Seattle Saturday afternoon, November 6, victim of a heart attack.

With his wife, Dr. Fisher was on his way to the Washington-Oregon football game. He complained of not feeling well and, instead of proceeding to the stadium, drove to the home of a friend, Dr. Paul D. Lewis, 1103 Fifth Avenue West. Death came soon afterward.

Dr. Fisher had practiced dentistry in Tacoma since 1922, when he moved there from Walla Walla. He was born in Ogden, Utah, June 6, 1892. He started school in Cleveland, Ohio, but later went to Portland, Oregon. His father, Dr. Benjamin H. Fisher, was a dentist, and he decided to follow the same profession. He was a graduate of the North Pacific Dental College there.

Following school, Dr. Fisher practiced in Portland for seven years. He spent ten months at Fort Lewis during World War I. He was a member of the Pacific Coast, American, and International societies of Orthodontists, the Tacoma, state, and national dental societies, and Xi Psi Phi, the dental fraternity. He was a member of the University-Union Club.

His wife, Gladys, of the home at 4117 Madrona Way, survives.—*Tacoma Tribune-Ledger.*

Dr. Charles S. McCowen

The sudden death from a heart attack on Dec. 19, 1948, of Charlie McCowen of Palo Alto, California, came as a shock to his fellow members in the Central Section of the Pacific Coast Society of Orthodontists.

A real veteran in dentistry, he graduated from the University of Pennsylvania in 1899 and later, branching into his favorite specialty, he practiced orthodontics in Palo Alto for many years.

Born in 1869, he would have, next year, rounded out a full life of fourscore years, although ably concealed by a physical appearance and keenness of mind of a man ten to fifteen years his junior. His warm and friendly personality was refreshing to encounter at our meetings at which he probably attended with greater regularity than most members.

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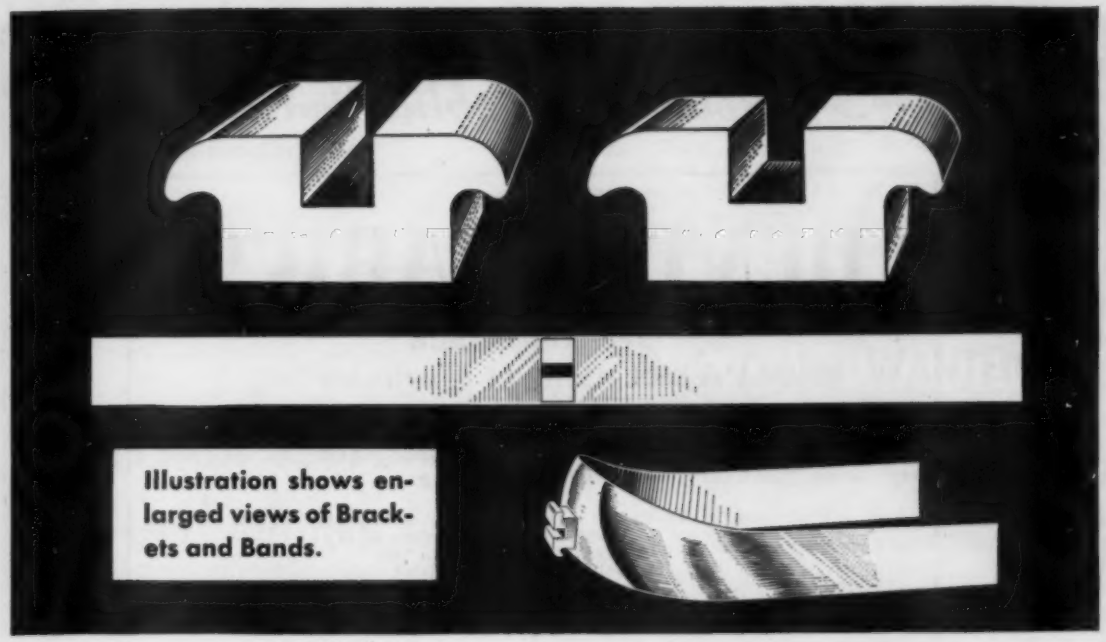

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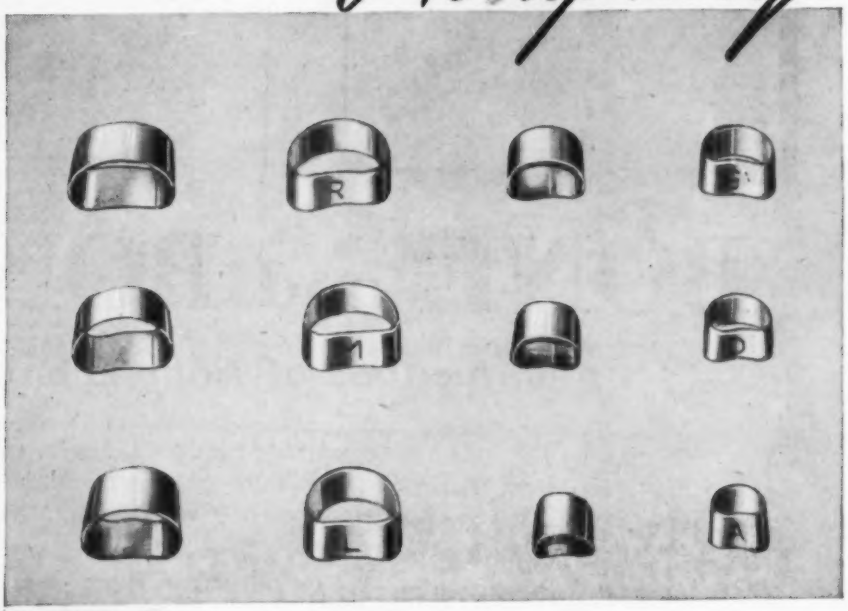

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